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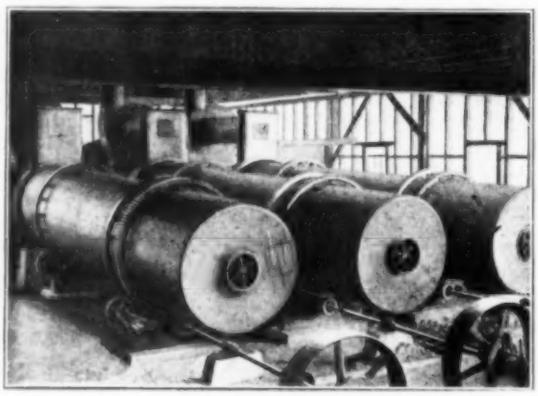

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The Cost of Hospitality

IF FORTUNE favored you with attendance at the Chicago meeting of the American Chemical Society week before last you probably were impressed with the generous hospitality and the cordial goodfellowship that marked that happy occasion. From Northwestern University on the north to Chicago University on the south and among the industrial plants in the environs of the city there was open house for visiting chemists. Careful forethought was given to every detail and a suitable setting was provided for every function. The program proceeded with clocklike precision. At no recent convention within our recollection, confined to a single city, was there a better opportunity for social intercourse as well as exchange of technical information. The entertainment was in good taste, and personal preference was anticipated in great variety. If there was a hitch anywhere it was not evident to the visitor.

We wonder, however, whether those who enjoyed all that was offered had a lively sense of what was involved in preparation for the event: the detailed work of committees, the co-operation of varied interests, the conferences, the devotion of time and money. We may take for granted the personal service and sacrifice involved in preparing for a great meeting of scientists, but the financial burden is likely to be overlooked and not appreciated. Certainly $20,000 would not cover the cost of entertainment and hospitality afforded at Chicago. Somebody has to pay for special trains, dinners, orchestras, operettas, organ recitals and all the trimmings that go to make up a successful convention. Undoubtedly the most distasteful job was that of the finance committee, which had to solicit funds from companies which, in many cases, had only a remote interest in the convention and whose ability to contribute constituted the best reason for approaching them.

In the light of these considerations the Council of the Society is to be commended for resolving that at future meetings the attendants shall bear a share of the cost of their entertainment. The mechanism whereby this is to be accomplished is not decided upon, but the principle is fair. We can go further and question whether, after all, it is necessary to provide entertainment on such a scale that it becomes a burden. As the Society foregathers at one city after another a commendable spirit of rivalry not only leads each successive local organization into emulation of the plans of its predecessor but creates a desire to "go one better," thus adding another limitation to the centers that are able and willing to act as occasional hosts to the parent organization. From every point of view it seems as though less stress should be laid on the formal entertainment of guests and more on the facilities and natural attractions of possible convention centers. Delightful as the social features are, they may add too much to the cost of hospitality.

The First Meeting of American Engineering Council

ANNOUNCEMENT is made elsewhere in this issue of the first meeting of American Engineering Council of the Federated American Engineering Societies. It will be an important occasion in the history of American engineering, and the national capital will be a fit setting for it.

We have followed with more than ordinary interest the development of this organization, which is an earnest attempt to provide a vehicle for expression of engineering thought and for impressing that kind of thinking on public affairs, municipal, state and national. Of the value of engineering opinion on public affairs we are thoroughly convinced, and we are committed to the necessity of making the composite engineering thought of this country articulate. The war brought the engineer and kindred technical men out of their professional seclusion and aroused in them a modest sense of importance in the general scheme of things. The consciousness thus created must now be fostered for at least two good reasons: recognition of engineers as a powerful and intelligent group of citizens, and the benefit which will result to the country from their participation in the conduct of its affairs. The effect will be cumulative. Intelligent participation will lead to public recognition of the profession; and that public recognition, in turn, will foster the spirit of professional solidarity and consciousness that will encourage further public service.

The principal need at this time is an active instrument for accomplishing these aims and purposes. The work of the Organizing Conference in Washington last June resulted in the creation of the Federated American Engineering Societies. Its constitution calls for representation of constituent societies in American Engineering Council, which, in turn, shall function through an elected Executive Board. It is for the formal organization of the Council and its Executive Board that the forthcoming Washington meeting is called.

The Federation is now an established, going concern. Since it was organized last June, five societies, national and local, have joined, making it the largest engineering society in the world. Delegates from the member societies—American Society of Mechanical Engineers, American Institute of Electrical Engineers, Technical Club of Dallas, Cleveland Engineering Society and Detroit Engineering Society—will comprise and organize American Engineering Council. Between now and November

18, when the meeting will be held, as many as possible of the fifty-seven societies which participated in the Organizing Conference last June, should take action on membership in the Federation so that they can send delegates to the opening session. The success of this movement is not going to reside in the participation of the large national societies alone, but in the large number of local, state and regional organizations that can represent engineers from every part of the country. On these bodies we urge immediate and favorable action. Two months remain in which to inform their members of the movement, stimulate interest and hold a referendum.

We are unwilling to believe that, if the aims and purposes of the organization are placed intelligently before engineers generally, they will fail to give it cordial support. And we are equally certain that in joining the movement every society will be rendering an incomparable service to engineering. From now to November 18 should be a campaign period for membership in the Federated American Engineering Societies.

Keeping the Two Schools of Chemists Apart

AT THE semi-annual luncheon of the Harvard Alumni Chemists Association during the A.C.S. meeting at Chicago, Dr. WILLIAM J. HALE voiced the opinion that the chemical department of the college and graduate school should confine itself to pure science and not allow industrial interest to divert the attention of the students. Granting the need of sound scientific training, we might report Dr. HALE'S remarks without any comment, but the situation really calls for a little illumination.

Back in the '50s when Professors COOK and HORSFORD taught at Harvard College and Lawrence Scientific School, respectively, the students of the one were not allowed to attend the lectures of the other. That they should have been denied the privilege was a great misfortune, especially for Professor HORSFORD'S students, because the latter cared little for teaching and devoted almost his entire attention to phosphoric acid technology. Ever since, it has been the experience of the university that the best teachers usually have been those who have not had their attention divided between industry and science, who did not seek the financial reward of the former but were content with the honor attached to the latter. This has had important exceptions, the faculty of the graduate school of engineering being the most notable. Recently it has been decided to place industrial chemistry in the Harvard Engineering School and professional industrial chemists will be invited to join the faculty on a part-time basis.

Professor PAUL G. BAXTER has been appointed director. He is a great teacher, being a leader in the instruction of quantitative analysis. The future success of the industrial course depends on two things: Teaching engineers must be enlisted of the caliber now serving in the mechanical, civil, sanitary, metallurgical and electrical departments, able men, such as MARKS, DAVIS, SWAIN, HUGHES, WHIPPLE, SAUVEUR and KENNELLY. Next this new department must be tied up with and get co-operation from the chemical, physics, mathematics, economics and English departments. All policies such as Dr. HALE advocates should be limited in execution, the college laboratories never being allowed to become the hired workshops of industry or the playground of would-be chemical philosophers. Chemical engineers must be well founded in pure science and their attendance should be welcomed in the chemical courses. It does not seem right that the engineering school should be forced to establish a department of its own, though it did so in mathematics, but by reason of the large numbers requiring specialized mathematics.

Steering An Even Course

THE War Trade Board has announced that it "does not feel it advisable to take active steps to place upon the market foreign-made drugs which would compete with those of domestic manufacture, and therefore will not exercise its option upon impounded stocks of chemical drugs of German manufacture or upon stocks of chemical drugs manufactured during the months of January, 1920, to June, 1920, inclusive." In choosing this course the Board avoids the Scylla of encouraging competition with domestic industry.

Moreover, to reassure us that we are not to run upon Charybdis, which guards the other side of the entry to our port of established chemical industry, we also read that undue aloofness in international trade is not to be expected. The Board says: "This Government will, however, retain its right to participate in allotments from future daily production of chemical drugs which may be manufactured by Germany during the next four and one-half years, in view of the possibility that a need in this country may arise at some future time for certain chemical drugs which may at that period be unobtainable from domestic sources."

The principles which guide to these decisions are right and rightly applied here. The only question which can disturb us is whether there will be enough facts always at hand to permit intelligent decision upon each new case which will arise. The industries must see that there is no lack of such information, both with respect to industrial needs and regarding the demonstrated ability of industry to fill these demands.

What About It Next Time?

THE War Department has just announced a summary of the causes of injury resulting in admission to American Expeditionary Force hospitals during the war period. Gas was the most frequent cause of injury, having occasioned almost 90,000 hospital cases, or over one-third of the total. The chemist can well ask what will happen next time, when the practice of gas warfare will doubtless begin from the outset and continue even more vigorously than it was practiced at any stage of the recent hostilities. It seems that this situation alone should be ample demonstration of the need of continued support for the Chemical Warfare Service not only by chemists but also by the General Staff of the Army, which as yet does not seem to have "seen the light."

It is to be hoped that both offensive and defensive preparations by this arm of the service will be developed to the full. We have no desire to develop our military forces to the point where, like Germany's, it will wag the entire economic life and international relations of the country, but they were at least prepared—so prepared in materials and methods that two allied soldiers had to give their lives to kill one Hun.

The Peace Treaty And Germany's "Ability"

EXTENDED reference to the moral and political questions involved in the Treaty of Versailles is not especially called for in these columns, but discussion of the engineering, metallurgical and economic matters bearing upon fulfillment by Germany of the treaty's terms is strictly in place. As everyone knows, there is heated debate in many quarters as to Germany's "ability" to carry out the terms imposed. From most of this debate knowledge of what engineering has accomplished and recognition of how industries have grown are conspicuously lacking.

There is the question of Germany's ability to furnish certain tonnages of coal. This matter is sagely discussed on the basis of the quantity of coal Germany was producing before the war. There is no reference to the quantity of coal lying beneath Germany's soil or to the number of men that can be transferred from the prosecution of strictly private affairs in Germany to the equipment and operation of coal mines and to the provision of the necessary transportation. It is an engineering or industrial fact, however, that a country can increase its production of coal and its capacity to produce coal. There is the case of the United States, for example. Fifteen years ago, in 1905, we produced 315 million net tons of bituminous coal, which was a large output for the time, being a 12 per cent gain over the previous record, made a couple of years earlier, so that it is fairly citable as a measure of the state of affairs in the United States in 1905. If we had been signing a peace treaty in 1906 requiring us to furnish coal to the victors, the 315 million tons would have been used by the statesmen as the measure of our ability. Now, however, we have the United States Geological Survey reporting that in the week ended Aug. 21 last we produced 11,048,000 net tons of coal, and that the average operation of the mines was 60 per cent, this being in reference to mine capacities based on an eight-hour day. Working an average of 4.8 hours a day, our mines actually produced coal at the rate of 575 million tons a year, or an 83 per cent gain in fifteen years, while our capacity, if we pulled ourselves and our railroads up to the point of eight-hour operation, would be just three times our output of fifteen years ago.

That is the viewpoint of engineering and industry rather than of statesmen and those who defend or criticize them. Germany's production of coal had actually increased by 18 per cent in ten years before the war, but that was a matter of business. It was not the measure of ability to produce or to increase productive capacity. In the same period the production of iron ore by Germany and Luxemburg had increased by 69 per cent. That increase was due to the fact that the increase was desired.

As inappropriate as the disregard of engineering and industrial possibilities is the importance attached to the redistribution of the Minette iron ore deposits. It is even alleged by some that the mental attitude of the men in the respective countries will prevent the iron ore being used to advantage. Of course Europe cannot be repaired physically if mental attitudes are allowed to stand in the way, but what is physically necessary to be done must be done. The whole space circumscribed by the ore mines, coal mines and blast furnaces involved in the peace treaty is astonishingly small from the viewpoint of what the American industry does. Thirty, fifty, seldom more than a hundred miles! We transport iron ore from the Mesaba Range a thousand miles to Pittsburgh, and bring ore from Cuba and Chile to Pennsylvania.

Time may be required for the necessary equipment to be provided and for business arrangements to be made, but the iron ore and coal are in the occupied territory, some blast furnaces are there and others can be built. The things necessary will have to be done. The Treaty of Versailles might be all right or all wrong—neither of which it is—but an American engineer would be far from holding up his helpless hands if he had to get out the necessary quantities of ore and coal asked for. Give him time to organize the task along sound engineering principles, and the job would be merely a routine matter.

Steel Treaters, Bon Voyage!

PHILADELPHIA entertained the first meeting of the amalgamated heat treating societies last week, and the occasion gave gratification to its sponsors. A few scientifically inclined men working in hardening and tool rooms realized the advantage of interchanging experiences only a few years ago, yet the movement, started in so small a way, has gathered great impetus within the past year or two, and the technical meetings, industrial exhibits and other features of this convention were quite worthy of a long-established society.

As pointed out by ALBERT E. WHITE, the president, the outstanding opportunity of the new society is to replace the rule-of-thumb methods inherited from an ancient and honorable craft by the scientific control made possible by researches into physical metallurgy. Primarily, of course, it will do its share in this big task of education by exchange of information in the local and national meetings; an intelligent and inquisitive state of mind, if it can be thus aroused, will go forward by its own volition. In addition, steel maker and steel treater can be brought closer together. This new society is not greatly interested in the metallurgical and mechanical operations in the steel mill; it primarily wants to know how to distinguish good steel from bad, and then institute the proper methods of working stock metal into highly fabricated articles of unexceptionable endurance and quality. Yet the steel maker should know the steel-treater's requirements so he can furnish the raw material; on the other hand reciprocal knowledge is necessary so that the hardener may not try to develop properties not latent in his available raw material. Shop men, from foremen to apprentices, should also utilize the new society as a meeting ground. Most of the shop men are still craftsmen, practicing an art rather than applying a science. Foremen and managers can most easily dispel prejudice and ignorance, develop enthusiasm and enlist co-operation in the solution of vexatious economic problems of production by joining the artisans and technicians man to man in the technical sessions of this society.

Truly the newly amalgamated American Society for Steel Treating has picked out a limitless and inspiring field of action—education. Its influence for good should be immeasurable. Unquestionably we voice the thoughts of all men interested in making good steel better when we say heartily, "Godspeed!"

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Chicago Meeting of the American Chemical Society

An Account of the Social and Technical Features of the Sixtieth Meeting—Council Meeting—Addresses at the General and Industrial Division Meetings—Synopsis of Papers on Physical and Inorganic Chemistry, Cellulose, Sugar and Dyes

THE sixtieth general meeting of the American Chemical Society was held in Chicago, Sept. 6 to 10. Headquarters was maintained at the Congress Hotel, where several general lectures and the banquet were held. The technical sessions were held in the lecture rooms of Chicago University, while the social functions were given at Northwestern University. This scattered the meeting's activities over a rather wide area, but it was deliberately done in an attempt to adapt the various parts of the program to the most favorable environment. The lecture rooms of Chicago University afforded the best atmosphere and facilities for scientific talks, while the campus of Northwestern University could not be excelled for the social features which formed such an important part of this meeting.

Council Meeting

The Council met at 4 p.m. Monday at the University Club, about eighty-five councillors attending and President NOYES in the chair.

The date of the spring meeting was fixed for the week of April 25, 1921. The proposal of the Chemical Society of London to enable members of the American Chemical Society to subscribe for the annual record of the Progress of Chemistry prepared by the Chemical Society and the Society of Chemical Industry was referred to the secretary and the editor of *Chemical Abstracts* to arrange for subscriptions and deliveries.

Whether to hold the fall meeting in Pittsburgh or New York was left with the president and secretary with power to act. It is desired to make the meeting a joint one with the Canadian Chemical Society and the British or Canadian members of the Society of Chemical Industry in case this is possible, but this may only be concluded after a conference.

The invitation of the Federation of American Engineering Societies to attend its next meeting and to initiate plans for co-operation was declined. The resolution declining the invitation was unanimously recommended by the Advisory Committee, and the short discussion that followed was, with one exception, favorable to the resolution, and it passed. It was held that the Society should offer the Federation aid and encouragement in any manner it could, but that the fields of chemists and engineers were distinct and separate and that more and better work can be accomplished without interlocking the several organizations.

The editors of the various journals were re-elected, and vacancies on the associate boards were filled. The former editors of the Society's journal were severally elected to the post of editor emeritus.

The Pharmaceutical Division was changed in name

to the Division of Chemistry of Medicinal Products, with a view to making a clearer distinction between this Division and that of Biological Chemistry.

Dr. PARSONS reported informally on the meeting of the International Union of Pure and Applied Chemistry in Rome and was requested to give his report in full, already published in the *Journal of Industrial and Engineering Chemistry*, at the General Meeting on Tuesday morning.

It was resolved that the president appoint a committee of thirteen members, with Dr. Charles H. Herty as chairman, to represent the Society in co-operating with the Chemical Warfare Service of the U. S. Army in whatever manner they may be able. It is to consist of three members each representing research, development, production and physiological subjects.

The question brought over from the last (St. Louis) meeting whether or not the Society should meet but once a year at a general assembly, while other joint meetings of various sections be arranged according to geographic sections, brought forth extended discussion. It was lost by a large majority.

A resolution was introduced and unanimously adopted to the effect that hereafter it shall be expected of members and guests attending general meetings to bear a share of the cost of their entertainment, on the ground that the burden of expense assumed by the local sections which act as hosts is greater than is fair to ask of them.

ANNUAL DUES FIXED AT $15

At 6:30 the Council dined as guests of the Chicago Section at the University Club, and after dinner continued in the dining room to consider the final question at issue, which proposed such change in the bylaws as to make the annual dues $15 instead of $10. There was considerable division of opinion, and for a time the air was thick with amendments, but President Noyes, after splitting them up into their component parts, succeeded in getting the views and votes of the councillors on every phase of the question, and in the end it was resolved by a large majority that the dues should be $15 under the original resolution. The privilege of full membership and subscription to one of the society's journals for $6 was extended to include graduate students as well as students; and under another resolution it was decided to allow students and graduate students a discount of one-third, making the net cost of membership and all three journals $10, as before, instead of $15. The definition of a student for the purpose of the two last resolutions was referred to the president for determination.

General Meeting

At the General Meeting in the Gold Room of Congress Hotel Dr. JULIUS STIEGLITZ, the Honorary Chairman, made an address of welcome, and so did JOSEPH R. NOEL, vice-president of the Chicago Chamber of Commerce. Mr. Noel said that in reducing the cost of the necessaries of life chemists were humanitarians, and that the reduction of costs was the great problem of the day. President W. A. NOYES responded by emphasizing the obligations of chemists in reconstruction, observing that achievement is only possible in case they work together and unite in their efforts.

Secretary PARSONS made his report as requested at the Council Meeting on the meeting of the International Union of Pure and Applied Chemistry in Rome. As this has already been printed in full details will not be given here except that the Union has resolved to meet in Poland in 1921, and that martial conditions may prevent this. The members would like very much to hold an annual meeting in the United States, but the current rates of exchange make the undertaking too expensive. It is planned to have general meetings once every three or four years in the place of the former triennial International Congresses of Applied Chemistry, of which the last was held in New York in 1912. An interesting note made by Dr. Parsons was the disposition of Europeans in international conclave to discuss details in general meeting rather than to refer them to special committees according to American usage.

The General Addresses were made by THOMAS E. WILSON, president of Wilson & Co., packers, and Dr. A. S. LOEWENHART, head of the department of pharmacology at the University of Wisconsin.

CHEMISTRY IN THE PACKING INDUSTRY

Probably no man eminent in business affairs has been so unhappily bespangled by the advertising writer as Mr. Wilson, and it was a great pleasure to find that despite the scarehead "studies" of him he is a gentleman at once simple in speech and habit, clear in vision, concise in his statements and persuasive in argument. He gave an outline of the incidence of chemistry in the packing industry, which he said had had its beginning and development within the life of the present generation. When he first went into the stock yards (and according to "Who's Who," that was in 1890), there was no such thing as a chemical laboratory there. The first laboratory was opened by H. W. Schmidt, now of Cincinnati, and the undertaking was generally regarded as a foolish experiment. The first thing Mr. Schmidt did was to install a vacuum pan to make extract of beef. It was not a laboratory apparatus, nor was making beef extract a laboratory operation, but Schmidt kept it there in order to show a credit from the operation of his laboratory in the only language that was effective. The profit on beef extract made it "pay" the while he was able to continue in research, and finally to achieve results.

In the early stages the packers were merely butchers on a large scale, and they could not offer for a live steer more than they could get for the beef. Today the sum realized for the beef is much less than the price paid for the animal that furnishes it. Chemistry has made this possible. The establishment of Wilson & Co. started a few years ago with but one chemist; today it employs nearly a hundred, and these are divided into analysts, research chemists, chemical engineers and commercial or business chemists. The co-ordination of science and technology in the packing industry made it possible to do what would otherwise have seemed impossible when the call came in February, 1918, to furnish 300,000,000 lb. of pork products per month for three months on pain of losing the war. There was actually shipped 9,000,000,000 lb. in February, March and April of that year, at a time when the country was in large part snowbound and the railways were nearly broken down.

Chemical research and control have enabled the packing industry to operate on a very low margin of profit. During the fiscal year of 1919 just closed the five large packers did a business of $3,521,000,000 and made profits of $34,500,000. They handled 40,000,000 head

of live stock at a profit of 89½c. per head, the profit on the turnover being less than one cent on a dollar.

Mr. Wilson pointed out that whereas we have heretofore striven for volume the time has arrived when we must conserve what we have and strive for improvements. It sounds well enough to say that they use everything in the pig except the squeal, but the fact remains that there is still great work to do in the science and more particularly in the chemistry of the industry of packing, that many fields are still undeveloped for lack of adequate research, and that it is the business of the men of today to attack them. Speaking for the industry with which he is connected, he said there are great opportunities open to the chemist, and he believes that there are in other lines as well. In conclusion he urged chemists to offer their work to business men in a language that business men can understand. He was sure that this could be done, and he hoped chemists would master the art of doing it.

Chemistry in Biology

Dr. Loewenhart followed with a discussion of chemistry in biology. Biology, he said, rests on three systems: chemistry, physics and on one part which is pure biology. The only process in biology that yields energy is oxidation, and after a discussion of oxidation in respiration he noted that fats, hydrocarbons and proteins oxidize at 37 deg. C. within the body, while outside it they are stable at this and higher temperatures. The explanation of the fact is found in oxidizing enzymes, of which the chemistry is at once very complex and very interesting, as well as full of unanswered questions. Why, for instance, does dextroglucose oxidize within the body, and why does not lævoglucose do the same thing? Again, oxalic acid and carbon monoxide will oxidize without the body, but within it they will not. All recent work on slow oxidation shows a great difference between it and combustion. It also shows that interference with biological oxidation starts different series of processes within the body which yield entirely different end products from those reached by normal processes. Such disturbances are caused by various chemicals and by temperatures that are abnormal. Another interesting question has to do with the relation of internal oxidation to the stimulation of an organ.

An important note is the similarity of oxidizing enzymes to organic peroxides. Most important antiseptic agents are oxidizing agents, and these are useful when they are not interfered with by proteins. Certain such organic oxidizing substances, if injected intravenously, increase the production of anti bodies, and decrease the inflammation, while remaining unaffected by the proteins. Therefore organic peroxides are very important, and new and better methods of preparing them are needed, as well as are new organic peroxides. Indeed, Dr. Loewenhart issued what was in effect a call for new organic peroxides from chemists, in the hope that they may aid in the conquest of disease. They must not be too active, and yet they must be active enough. And they should be water-soluble.

The notion still seems to prevail that there is a specific cure for every disease. It dies hard, but it is hoped to overcome the superstition in time. Now some excellent drugs were in use apparently before the beginnings of history—as we have it—and some began in religious ceremonies in connection with sacrifices to various deities. The co-operative study of drugs and their effects, however, has had the surprising result that due to the activities within the Chemical Warfare Service we are better informed of the effects of a number of new substances than we are of medicines that have been in use over two thousand years. It was the co-operation of chemists, biologists and physiologists that made this possible.

WALK BY THE LAKE, NORTHWESTERN UNIVERSITY CAMPUS

In addition to his call for more organic peroxides, the speaker made a plea for real chemical training for those who are about to study medicine. It is, he held, almost impossible to superimpose chemistry upon the practitioner of medicine if he has not had the training beforehand; and he could even say the same thing of biologists. He has known only one who, having neglected chemistry in his academic years, went back and got it. Whoever would engage in research should first study chemistry.

Tuesday Afternoon and Evening at Evanston

At the conclusion of Dr. Loewenhart's masterly address the members ate an early luncheon and took special trains for Evanston, where the meeting continued on the campus and within the gymnasium of Northwestern University. Right here we desire to say —and we are likely to repeat it elsewhere—that the Chicago Section as hosts provided a rare welcome and entertainment for the members and guests of the American Chemical Society. In generosity, in careful and intelligent planning, and in grace, in charm, and—to apply an old meaning to a familiar word—in elegance, it has probably not been equalled in the history of the society. It would be hard to find a lovelier spot than the Northwestern campus on the lakeside. It was decorated with the colors of many universities and colleges, and few who were present will ever forget the beauty of the vision as they walked about before the afternoon session began in the Patten gymnasium. While the orderly arrangement could not have been brought about without complete team work on the part of the committee, it would be unfair to omit the special praise due to Dr. W. Lee Lewis, chairman of the Chicago Section and professor of chemistry at Northwestern University. There was not a hitch or a failure in the whole program. The only criticism that could possibly be

made was the heavy expense with which the Chicago Section burdened itself whereby it gave far and away more in the way of special trains and other pleasant conveniences than the Society could ask for or expect.

Dr. Talbot's Address

At 3 o'clock President Noyes called the meeting to order, and Dr. Henry B. Talbot, of the Massachusetts Institute of Technology, delivered an address on "The Relation of Educational Institutions to the Industries."

Dr. Talbot believes that men of business have too little understanding of the responsibilities, the obligations and the opportunities of the professors. Occasionally business men appear at colleges and universities and occasionally they lecture, but usually they fail in this because they lack the talent of exposition. It is easy enough to talk about hand-in-hand work and cooperation between industries and educational institutions, but as soon as we undertake a realization of this we find that it means considerable change of routine, and often it involves expense. Therefore the effort is likely to be abandoned at about this point.

Now the community has a right to demand that young men shall be trained in abstract science and in public affairs no matter what their profession or occupation is to be, and this holds especially true of those who are about to enter industry. The present performance does not seem wholly adequate, and yet the speaker believes that the indictment lay less against the training and instruction than against the attitude of graduates.

In the monograph on technical education prepared by C. R. Mann for the Carnegie Foundation the requirements were set down in what was deemed to be the order of their importance. Here character, initiative, leadership and responsibility and a long list of native attributes were listed before technical knowledge, which stood seventeenth instead of first. Colleges cannot select their raw materials; they must make their selection from what comes to them. Character may be developed in a measure by the supervision of student activities, but the process is not always effective. In regard to the quality of leadership it often happens that the best young men are debarred by the self-assertion of others who are far less worthy. There are schools of business and engineering administration that are designed to provide training for leaders, but while the form is new and it has promise, a difficulty lies in the selection of the right young men for these courses.

SCENE ON NORTHWESTERN UNIVERSITY CAMPUS

The atmosphere of a works is not and cannot be produced in a college. What the college tries to do is to arouse enthusiasm and eagerness to learn. The greater the effort a student makes to get his education, the greater as a rule is his appreciation of it. It is to be regretted that this ratio of appreciation to effort does not apply so frequently if the appreciation is expected of the student, in consequence of the efforts of his parents.

The speaker described the five-year course at the Institute of Technology that leads to the M.S. degree in connection with work done at the General Electric Works at Lynn, the Eastern Manufacturing Co. at Bangor, the Lackawanna Steel Co. at Buffalo, the New England Gas & Coke Co. and the Merrimac Chemical Co. at Everett. This course has already been described and discussed at length. It is open only to men of superior type who have already made good, and it has the destinctive advantage of revealing the practical value of "all that theoretical stuff," while it also trains men to handle others. There has been no trouble with the foremen and workmen in the works. They like it. The trouble is that many of the best young men cannot afford the five years.

Dr. Talbot made a plea for industries to take on for summer months the best students who are striving for the best education they can get but who are inhibited by the expense. It offers an excellent opportunity to get a line on a good man. Of course they are immature and occasionally they may be in need of a measure of forgiveness, but if we look back upon our own student days the chances are that we shall find traces of green paint there too. He made an urgent appeal for vacation positions in industrial works for good students.

Another point of contact which he believed might be developed with profit is the use of professors in research, not for problems of daily improvement and administration which are best worked out in the factory laboratory, but for special problems of a more abstract nature for which special training is necessary. He believed that this would also be of peculiar value to teachers, and that an occasional summer in the works would be of advantage all around. He concluded by an appeal to make use of members of college staffs as consultants, at all events until the supply of chemists is greater.

Walter A. Patrick, of Johns Hopkins, spoke briefly on the adsorption of vapors by silica gel, a special grade manufactured by the Davidson Chemical Co. of Baltimore being used. It was found that vapors of liquids of a high boiling point were more strongly adsorbed than those of low. Adsorption decreased with rise of temperature until the critical temperature was reached, where no adsorption took place. Full details of the theory and applications of adsorption were recently read before the A.I.C.E. and will soon be published in this journal.

The President was authorized to appoint a committee to revise the general programs of meetings of the Society with a view to providing more time for divisional papers.

As trustee of the body having in charge the collection and publication of physical and chemical contents Dr. Julius Stieglitz announced that this work was an obligation undertaken by the chemists and physicists of America and that the funds for the prosecution of it

were not yet collected. He urged upon members the need of providing funds for this purpose without delay.

It was also resolved to record the sincere regret of the Society that the dye bill failed to pass the Senate in the last Congress and that the urgent need of affirmative action in regard to it be taken at the earliest moment be communicated to the national legislature.

Entertainment and Reception

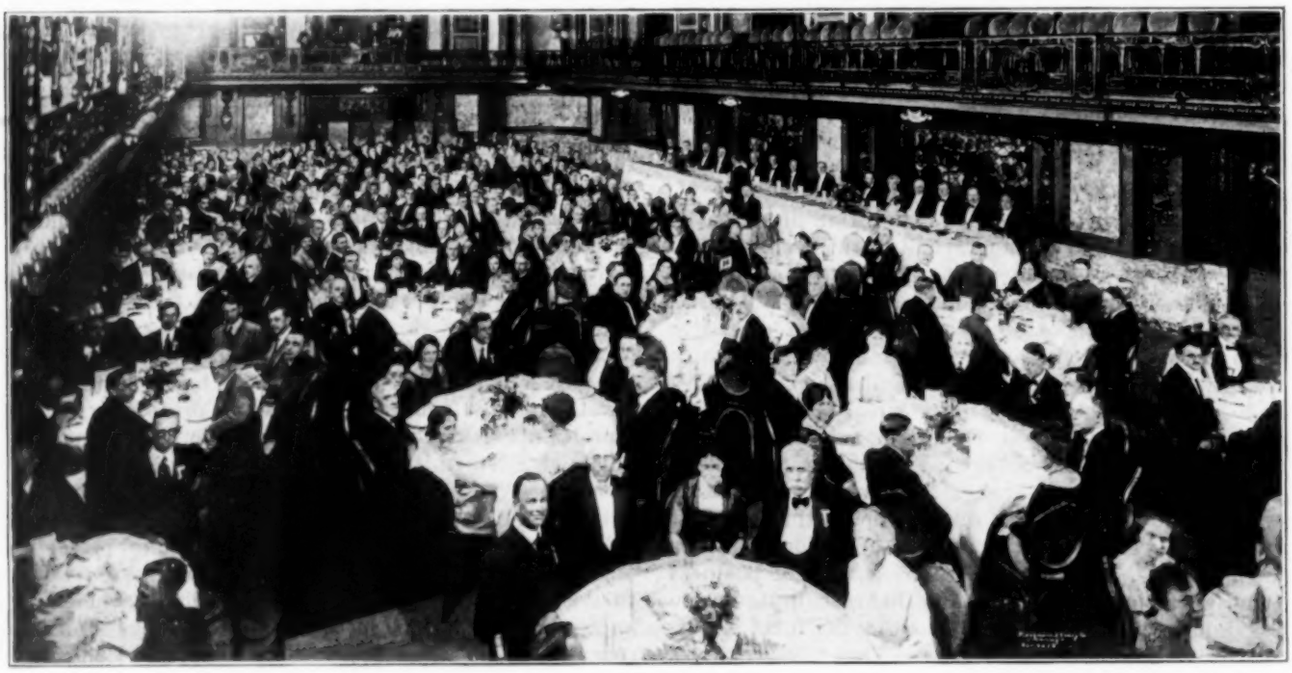
At the conclusion of Prof. Patrick's address the combined entertainment and reception began—from 4:30 to 10:30 at night. There was a concert by the Chicago Band on the lawn. About the campus at various tables punch was served by ladies of Evanston under the charge of Mrs. L. V. Redman and Mrs. W. L. Lewis. In the pool of the gymnasium, Tom Robinson, swimming instructor at Northwestern, gave an exhibition of swimming by his pupils, consisting of Evanston boys and girls that was as pretty a show as one could wish to see. It was more than that, it was a sight of memorable beauty to watch those lithe young bodies swimming and playing and racing—almost like so many seals. There was also an organ recital in Fisk Hall by Hugo Goodwin, and of course there had to be a baseball game on the campus in which the Chicago Chemicos under Dr. L. V. Redman challenged All the World which (i.e., All the World) was led by Dr. Charles H. Herty. Dr. Edgar F. Smith was umpire.

While all these activities were in progress there was a dance provided on the second floor of the gymnasium, and here again we cannot forbear to mention the distinguished quality of the hospitality of the Chicago Section. Mrs. Redman and Mrs. Lewis had secured the presence of the young women of the best Evanston society to meet the chemists and the only objection raised by those present was that it was all too short.

From 4:30 to 5:30 a visit was made by a number of the more technically minded to the Evanston Filtration plant, but there was abundant excuse for all who did not go, because there was so much doing on and around the campus and it was so engaging withal that it was asking too much to expect one to leave. At 6 a supper was served by the ladies of Evanston at tables arranged for alumni of the various universities and their wives, and by 7:15 the great hall of the gymnasium was filled again. Here twenty-five members of the Chicago Symphony Orchestra led by Osbourne McConathy gave a beautiful concert at once popular and distinguished. Then followed some good chorus singing by everybody present, led by Mr. McConathy, and after a few monologues there followed Gilbert and Sullivan's old operetta, "Box and Cox." The singers were well-known professionals, and the performance, with the Symphony Orchestra, went without a hitch and was delightfully rendered to its rollicking, cheerful end. Then special trains carried the visitors back to Chicago.

The Banquet

The banquet was held on Thursday evening in the Gold Room of the Congress Hotel. Dr. W. LEE LEWIS, chairman of the Chicago Section, presided, and he proved to be a witty toastmaster. The speakers were Raymond F. Bacon, Charles H. Herty, William A. Noyes, Harrison E. Howe, William R. Moss, an attorney of Chicago, and Otto Eisenschiml. Listed among the speakers was Miss Margery Maxwell, soloist of the Chicago Grand Opera Company, who sang selections from operas and songs occasionally between courses, and interspersed among speeches afterward. Miss Maxwell's contributions had the same quality of eminent distinction that characterized the complete entertainment provided by the Chicago Section.



SIXTIETH CONVENTION AMERICAN CHEMICAL SOCIETY BANQUET, CONGRESS HOTEL, CHICAGO, SEPT. 9, 1920

The speeches were short. Dr. BACON advised chemists to make themselves proficient as business men. Dr. NOYES emphasized the need of team work and ideals of service. Dr. HERTY made a plea for the dye bill. Major HOWE made a plea for better tools, among which the most important was the publication of tables of physical and chemical constants. Mr. MOSS wanted chemists to speak so that they could be understood by those who are not chemists, and Dr. EISENSCHIML told some profitable tales.

General Meeting, Industrial Division

CHARLES BASKERVILLE, of the College of the City of New York, reported that he has found several solvents for gaseous phosgene, among them gasoline, benzine and ethyl acetate, which dissolve about an equal weight of the gas at ordinary temperatures. These solutions do not have high vapor pressures, so may be transported with safety within ordinary closed containers. On exposure to the air the liquid and dissolved gas evaporate. By suitable distillation and rectification, the phosgene can be recovered from the solution in a pure state. The solutions of phosgene may find application as a rodent exterminator and offer a method of legally meeting the present railroad restrictions on the shipment of this poison gas.

ELECTROMETRIC METHOD FOR DETECTING SEGREGATION OF DISSOLVED IMPURITIES IN STEEL

EDWARD G. MAHIN, of Purdue University, gave an account of an electrometric method for detecting segregation of dissolved impurities in steel. If the hypothesis that steel acts to some extent as a solvent for segregation materials is correct, the electrode potential of the metal should be altered in the regions immediately surrounding the inclusion. It is not possible to determine this point by the usual method involving immersion of the specimen in an electrolyte, but a method was devised for exposing microscopic areas of metal surface to an electrolyte, so that the microelectrode thus formed could be connected with a standard calomel half-element and the emf. of the system measured by the compensation method.

SODA-LIME FOR INDUSTRIAL PURPOSES

ROBERT E. WILSON, director of the Research Laboratory of Applied Chemistry, M.I.T., gave two papers. The first, on soda-lime for industrial purposes, was an outgrowth of work done in the C.W.S. for military use. Industrial soda-lime must have greater activity and capacity. It need not be so hard nor contain an active oxidizing agent, both of which requirements seriously limited the efficiency of military soda-lime. The factors determining the type of lime and the percentage of caustic soda solution to use were found to be the most important variables.

The flow of viscous oils through pipes, a crude asphalt base and a refined high boiling point paraffine base oil being used, was next discussed and Poisenille's formula found to hold, in the following form:

$$P = \frac{0.000668\, z\, l\, v}{d^2} \quad \text{or} \quad \frac{0.000273\, z Q\, l}{d^4}$$

where P = pressure drop in lb. per sq.in.
z = relative viscosity to water at 68 deg. F.
l = length of pipe in feet.
v = velocity of flow in feet-seconds in pipe.
d = inside diameter of pipe in inches.
Q = flow in gallons per minute.

A log log chart for converting Saybolt, Redwood and Engler time for efflux to relative viscosity was given having co-ordinates z/sp.gr. and seconds. The points (18, 100) and (1,500, 8,000) determined the Saybolt line. The pressure drop through a 90 deg. elbow in equivalent lengths of straight pipe in units of pipe diameter lengths was plotted against the ratio v/z.

H. K. BENSON reported that rosin extraction has been under a heavy handicap due to the retention of the solvents by the wood to an extent of as high as 25 gal. per cord. Two solvents offer more economical extraction costs, 5 per cent ammonium hydroxide and 70 per cent denatured alcohol solutions. When resinous wood of pulp size is treated with eight times its weight of 5 per cent ammonium hydroxide for ten hours, 94.5 per cent of the rosin is extracted. The ammonia extract decomposes slowly in the air at ordinary temperatures, and at 90 to 100 deg. C. is rapidly and completely decomposed, yielding ammonia vapor and finely divided humus in suspension. Ammonia extracted wood chips can be completely de-ammoniated by steam distillation. Denatured alcohol at 70 per cent strength is as efficient a solvent for rosin as ammonia, benzene, or gasoline.

REPORTS BY OTHER INVESTIGATORS

H. C. HOWARD, of the B. F. Goodrich Co., reported that certain arrangements of rubber balls were found very effective vibration absorbers.

HUGO SCHLATTER, of the Hercules Powder Co., confirmed Senderen's experiments on the action of aluminum sulphate in the manufacture of ether. Lead sulphate, broken porcelain, etc., were found to have the same action in aiding the formation of the vapor phase.

HARRY MCCORMACK reported that benzene in motor fuel mixtures could readily be determined by bromene absorption. Evidently it is assumed that the petroleum fractions contain no double bonds, which does not seem justified.

W. D. COLLINS, of the U. S. Geological Survey, reported that the package committee recommended 500-g. containers for chemicals. R. M. WILHELM'S report on standard thermometers and F. W. SMITHERS' specification on sulphuric acid were given.

O. L. BARNEBEY, of Columbus, Ohio, spoke on the recovery of industrial vapors with activated charcoal. This material has been greatly improved since the close of the war and has much greater absorbing capacity than gas mask charcoal. It has proved excellent for the recovery of ammonia, sulphur dioxide, spent acid vapors, and solvents such as ethyl ether, gasoline, toluene, benzene, carbon tetrachloride, choroform.

H. V. MAIN, formerly engaged in the manufacture of metallic arsenic with the Hoskins Process Development Co., described a nose dust respirator. Australian lamb's wool pads are held firmly over the nostrils by means of a guard made of packing rubber.

O. R. SWEENEY, of the University of Cincinnati, reported that a marked increase in the initial rate of hydrogenation of cottonseed oil with cobalt catalyzers was found when over 10 per cent of hydrogenated fat was present. This indicated that the product of the reaction had some undetermined role in the reaction itself.

CHARLES L. PARSONS gave an account of a special study, which he had recently made while in Europe, of the application made there of ammonia oxidation for the production of oxides of nitrogen to be used in the manufacture of chamber sulphuric acid. In Germany this method was used almost exclusively, while in England about thirty plants have adopted it. About 20 per cent saving was obtained and such impurities as chlorine were not accumulated in the chambers, as in the ordinary niter process.

Physical and Inorganic Chemistry

R. H. BOGUE discussed the hydrolysis of sodium silicates, showing that the resistance to hydrolysis increases with the amount of silica in the compound.

H. H. WILLARD and R. K. MCALPINE made a final report on the revision of the atomic weight of antimony using carefully purified and fractionally distilled tribromide. The value obtained, 121.77, is considerably higher than the one given in the international table.

LOUIS KAHLENBERG showed how certain crystalloids like lithium chloride, silver nitrate or cane sugar could be separated from other crystalloids, including sulphur, camphor or napthalene, using pyridine as solvent and a vulcanized rubber membrane. Any of the last three mentioned would be separated from any of the first three by passing through the membrane. In a similar manner it has been possible to separate certain colloids from certain crystalloids by having the colloids pass through the membrane.

HARRY N. HOLMS and W. C. CHILD described the action of gelatine in securing emulsions of water in kerosene. The stability of the emulsions was greatest for a definite viscosity which could be obtained either by using pure gelatine, by using less gelatine with a coagulating agent like sodium sulphate or by using more gelatine with a peptonizing salt of the type of sodium iodide.

Using electrometric titration, W. S. HENDRIXSON has been able to show that on titrating potassium dichromate against hydriodic acid there was no evidence of any superoxidizing power. Air has no effect on this titration.

W. D. HARKINS pointed out that the generalization of the ratio of one electron to two positive charges in the nuclei of most of the atoms would hold for that isotope of lithium having an atomic weight of 6.

ARTHUR E. HILL has found that silver perchlorate, a strong electrolyte, when shaken with water and benzene, is found to the very slightest extent in benzene in spite of its appreciable solubility, 25 g.p.l., in that solvent. This indicates that it exists as entirely different molecular species in the two solvents. On using solid salt in excess it is possible to cause the separation of a layer of liquid in this system. W. D. BANCROFT pointed out the probable existence of a large number of similar cases.

D. A. MACINNES, by multiplying together the ionic transport number, the equivalent conductance and the viscosity for solutions of the chlorides of hydrogen, potassium, sodium and lithium, obtained a constant value at 0.2 normal and 1 normal concentrations.

A. F. O. GERMANN has studied the cryoscopy of the systems of boron trifluoride with hydrogen sulphide, phosgene, sulphur dioxide, nitric oxide and hydrogen chloride. In each case one molecule of the trifluoride combined with one molecule of the other and in some cases evidence was obtained of the existence of an unstable compound between one molecule of boron trifluoride and seven molecules of the other.

ELLIOT Q. ADAMS pointed out a number of peculiarities of the actinium series which indicate that it may be of independent origin. A new name for the inert emanations of these three series, radon, actinon and thoron, was proposed.

A report was given of the progress of Dr. ACREE in the study of the hydrogen electrode with F. A. ELLIOT and Miss A. D. DUSHAK. By the use of combined hydrogen-calomel electrodes the contact potential for solutions of potassium chloride has been determined and found to check the calculated value rather closely. To secure greater accuracy, more than one electrode can be used.

S. E. SHEPPARD and F. A. ELLIOT have found that the gold number has no connection with the quality of a gelatine. The great care in the making of gold hydrosols in order to secure a gold particle of uniform size was emphasized.

H. B. WEISER and ALLEN GARRISON have been studying the oxidation of phosphorus. When the current of air or oxygen is increased the rate of oxidation is decreased. On the other hand any increase in amount of phosphorus vapor increases the amount oxidized.

F. DANIELS has made a study of the thermal decomposition of nitrogen pentoxide and finds it to be a molecular reaction. From the velocity of the reaction the heat of the reaction had been calculated. According to the quantum relation using this reaction heat the pentoxide of nitrogen should be decomposed by infra-red light, $\lambda = 1.15\ \mu$. Actually, however, blue light of much higher frequency is required. A possible explanation of this is that there is an induction period till some tetroxide is formed, after which the reaction goes more rapidly. It is possible that the lower oxide absorbs the blue light and re-emits it in the infra-red.

H. S. TAYLOR is carrying out some important studies on catalytic hydrogenation at Princeton University. The mechanism at the surface of the nickel catalyst has great technical interest.

In the study of the hydrogenation of benzene it had been found that at 180 deg. C. the formation of cyclohexane is complete, but at 300 deg. dehydrogenation sets in and carbon is formed. Dr. TAYLOR and G. DOUGHERTY showed that at 200 deg. an equilibrium is secured with 92 per cent cyclohexane. The velocity of the reaction does not fit the mass action law for three molecules of hydrogen, but does fit it for one molecule. In a similar way it had been noted that the reaction velocity for the oxidation of carbon monoxide in contact with quartz glass is proportional to the square root of the carbon monoxide concentration. These results tend to show that a catalyst may considerably alter the mechanism of a reaction. The final result, however, is probably not affected.

Cellulose Symposium

The program of the Division of Industrial and Engineering Chemistry opened on Wednesday morning with a second Cellulose Symposium, which had been organized in accordance with a vote passed at the St. Louis meeting. That the interest in the subject justified the action was demonstrated by the fact that nearly 200 members were present at the meeting.

REGENERATING BOOKSTOCK

The first two papers were directly in line with the motto of the Chicago meeting, "Increased Production Through Chemistry." The first of these was "Regenerating Bookstock," by CHARLES BASKERVILLE and CLARENCE M. JOYCE. The possibilities were pointed out of regenerating the chemically prepared pulp to be found in old magazines and books rather than using it for boxboard, roofing paper, etc. A new patented process for doing this was presented which consists in mechanically loosening and drawing apart the fibers

with as little tearing as possible. The ink is then "lifted" by treatment with borax, soap, kerosene and pine-oil. The pigment particles of the ink thus loosened are carried away in a subsequent washing.

Recovering Newsprint

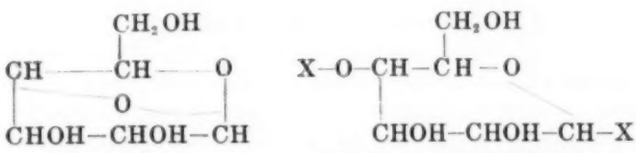
In the second paper, entitled "Recovering Newsprint," Charles Baskerville and Reston Stevenson presented a novel method for completely de-inking newsprint stock containing a large percentage of groundwood, with a minimum production of yellow color. The method depends on the use of American fullers earth suspended in the alkaline solution used for pulping and lifting the ink. The oils of the ink are adsorbed by the earth and the solid particles of ink adhere to it. The fullers earth is then washed away through a fine screen, leaving the pulp free from pigment and binder, and as clean as when first made.

Cellulose Content of Various Compound Celluloses

In discussing "The Cellulose Content of Various Compound Celluloses," Prof. Louis Kahlenberg presented results of experiments in which the cellulose content of various compound celluloses had been estimated by the ferric chloride hydrolysis method. Twelve different woods, nine straws, nine nutshells and two barks were investgated. Where comparable results have previously been published, the present results are of the same order of magnitude.

The Constitution of Cellulose

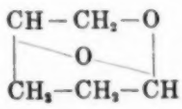
The most important paper of the symposium was on "The Constitution of Cellulose," by Prof. Harold Hibbert. About an hour was devoted to the presentation of this paper and the considerable discussion which it aroused. Formulas which have previously been proposed by Tolens, Cross and Bevan, Green, Vignon and others were first briefly considered and the facts pointed out which any structural formula for cellulose should explain. The new formula which Dr. Hibbert proposed explains all of these and some others. The formula follows:



Simple Molecule

Ordinary or polymerized molecule
X = Simple Cellulose Molecules

A characteristic feature of the new formula is the presence of a primary alcohol group which the recent work of Denham and Woodhouse and of Pictet has shown to be present. Up to the present, work on the constitution of cellulose has been carried out chiefly along the lines of (1) "Hydrolysis," (2) Xanthogenate Reaction, (3) Acetolysis, (4) Methylation. The author has started work on the direct synthesis of cellulose by synthesizing



and outlined a method on which he is working for the synthesis of mono-molecular cellulose. A new formula for starch was also proposed and the application of the new formulas was indicated in explaining the formation of dextrose, starch and cellulose in plants.

The Acid Hydrolysis of Sugarcane Fiber and Cottonseed Hulls

In the absence of the authors, E. C. Sherrard and G. W. Blanco, the next two papers were presented by Dr. Hawley. In the first one, on "The Acid Hydrolysis of Sugarcane Fiber and Cottonseed Hulls," it was shown that by one method of treatment bagasse gave about 27 per cent xylose and cottonseed hulls 14 per cent; by a second method, bagasse gave 21 per cent figured on the dry fiber basis, and of this 57 per cent was obtained crystalline. It was pointed out that pentose sugars influence the equilibrium which is established in the conversion of cellulose to hexose sugars by hydrolysis. When present in sufficient quantity, they entirely prevent the formation of fermentable sugars. Attention was called to bagasse as a promising source of xylose or furfural.

Hydrolyzed Sawdust as a Cattle Food

In the second paper "The Preparation and Analysis of a Cattle Food Consisting of Hydrolyzed Sawdust," results were presented indicating that a cattle food with a very considerable food value can be prepared by hydrolyzing Eastern white pine sawdust with sulphuric acid of 1.8 per cent concentration for twenty minutes at 120 lb. steam pressure. The average of twenty-nine cooks showed a yield of 18.85 per cent total sugars. The indications are that there are other digestible ingredients which have food value besides the sugars. Feeding experiments seem to justify further work and this is now being conducted.

A Comparison of Wood Cellulose and Cotton Cellulose

Another contribution from the Forest Products Laboratory was "A Comparison of Wood Cellulose and Cotton Cellulose," by S. A. Mahood and D. E. Cable. Samples of wood cellulose and cotton cellulose which had been subjected to various conditions of cooking and bleaching were analyzed to determine first, the best conditions for high yield of purified cellulose, and second, to determine points of similarity of difference in cellulose from wood and that from cotton. Munition linters were taken as standard and suggestions were offered for improving the yield of similar cellulose from wood. Acid cooking or acid and alkaline cooking are more effective for this purpose than alkali cooking. It was pointed out that since the results showed that cellulose from wood was a different chemical aggregate from cellulose from cotton, the practice of checking wood cellulose according to the specifications for cotton is questionable.

The next paper on the program had to be omitted owing to the inability of Dr. Hugh P. Baker to be present at the symposium.

Cellulose Mucilage

In a paper entitled "Cellulose Mucilage," which was presented in abstract owing to the author's absence, Dr. Jessie E. Minor pointed out that recent work of Schwalbe and Becker confirms her theory that reactive,

insoluble, colloidal hydrocellulose is pure cellulose which has adsorbed dextrines formed by the hydrolysis of some of the cellulose itself. These dextrines thus adsorbed catalyze further hydrolysis, as does also hemicellulose or acid treatment of the pulp prior to beating. Use is made of this phenomenon in making parchment paper. The adsorbed dextrines assist in holding size, dye, coating, etc., but impregnation with metal weakens the strength of the resulting paper.

Cellulose Section to Be Formed

Following the formal papers, consideration was given to the advisability of forming a Cellulose Section, a number of those present taking part in the discussion. It was the unanimous opinion that both the importance of the cellulose industries in this country and also the interest in the subject manifested at the two symposia were sufficient to justify the formation of a Cellulose Section, and it was voted that the necessary steps should be taken for the formation of such a section.

Section of Sugar Chemistry

C. E. Coates, discussing the subject of "Refining Raw Sugars Without Bone Black," explained the important economic development which would be possible through the use of Louisiana sugar factories as refineries during the period of the year when not active for direct cane campaign. The use of bone black methods of refining in these plants is inexpedient, as the required extra investment would be considerable.

This author presented a large number of results from his own experience where various systems of operation had been attempted. Sulphatation, sulphitation, carbonation and direct filtration processes were all discussed. Yields were presented for these various processes under different circumstances, showing that with careful control returns which compare favorably with some refinery practice can be obtained.

Important results were reported particularly on the use of activated char. This material as prepared from rice hulls and other sources lends itself to frequent revivifying by washing and several reburnings at longer intervals. In one case thirty successful uses of certain samples of char seem to be entirely feasible. The use of kieselguhr was also discussed in this connection.

Application of Clarifiers

W. D. Horn reported on the application of the Dorr classifier and the Williamson clarifier. The former apparatus, commonly used as a thickener for metallurgical slimes, lends itself also to the separation of insoluble materials from cane juices. A system of continuous subsidence and decantation of the clear liquor is accomplished, it is claimed, with very little inversion, the production of a clear juice, and a large fuel saving. The Williamson clarifier operates with violent aëration of the warm solution and subsequent skimming from the surface of the liquid in shallow pans of the scum thus collected. The skimming permits siphoning off of clear liquors and is reported to be very satisfactory.

Sugar Industry of France

T. H. Murphy, discussing the sugar industry of France, reported interesting figures regarding the present status. Before the war 213 factories had sufficient output to permit exports of 80,000 tons per year. The present output of sixty rather small factories leaves a deficit requiring import of 400,000 tons. It is reported that 142 factories were 85 per cent destroyed, particularly by removal of the copper equipment and the electrical apparatus and machinery. The damage is estimated by this author at $89,000,000. Reconstruction is inevitably slow because of the very special equipment needs of the factories.

Sugars in Bacteriological Work

E. H. Eitel discussed the application and availability of certain rare sugars for bacteriological work. These are applied particularly for the differentiation between different classes of bacteria, affording an important field where co-operation of chemist and bacteriologist is essential.

Laboratory Methods

Laboratory methods received considerable attention, especially by a group of papers presented by F. J. Bates and his associates in the sugar laboratories of the Bureau of Standards. C. A. Browne reported on a graphic method for estimating reducing sugars in the presence of sucrose. His charts will permit correction for dextrose figures between zero and 250 mg. in the presence of sucrose ranging from zero to 5 g. The same author discussed fully the chemical, physical, mycological and entomological characteristics of imported cane sugars.

He pointed out that the trend at present is to produce 96 deg. test sugar. There is some 98 to 100 deg. test imported for direct use and slight indication that more of this will be imported, especially if care and cleanliness are exercised in preparation of material suitable for direct consumption.

Changes in Sugars During Refining

Discussing the changes in sugars during refining, A. F. Blake treated the relationship of Clerget values to plant processes and stages. He pointed out the importance of true sucrose determination in order to secure reliable information for plant and refinery control. The true percentage of sugar is not usually computed from polarization figures and one may be misled if this is not done, with serious consequences.

Division of Dye Chemistry

New Naphthalene Dyes, by A. S. Wheeler. When naphthalene is sulphonated to a disulphonic acid in the 1-5 position, then treated with NaOH and oxidized, a product called juglone is produced, and this, treated with bromine or with chlorine, gives a series of red, yellow and brown dyes that are very beautiful on silk. The colors range according to mordants—which are necessary only for shade—from red to brown and yellowish bronze. He suggested further coupling with azo compounds.

Applications of Maleic and Fumaric Acids and Their Salts in the Textile Industry, by J. H. Carpenter, of The Barrett Co. These are now available in commercial quantities, and their uses are indicated as mordant assistants in chroming, in wool printing, in silk dyeing and finishing, increasing luster, and in certain blacks on cotton and in mercerizing. The acids are oxidation products of benzene in which vanadium is used as a catalyst.

The Education of the Research Chemist, by R. E. Rose, of the du Pont company. The author pointed out that the dye industry of the United States represents

a large-scale experiment with men not experienced in the industry. He traced the education of the men so taken over in general, and expressed the belief that the educational system of the country was the best available to develop ingenuity, energy, etc., but that it was less effective in preparing for advanced research. Many failures were due to the fact that men experimented first and thought afterward, while the opposite is the rule of research. Another defect was the tendency to get quick results by hitting the high spots. Then all the valleys have to be laboriously filled out. Often, too, in industrial laboratories the quantities used in experiment were so large as to delay results. He was urgent in favor of training in history, English, etc., and a better grounding in the principles of physics and chemistry in preference to technology courses.

Dr. DERRICK, of the National Aniline Co., pointed out the peculiar value of group work in research, holding that two good men working together and helping each other are worth more than four good men working alone.

There followed several papers from the Color Laboratory of the Bureau of Chemistry at Washington on photo-sensitizing dyes, and one by C. R. SENSEMAN which bore on the production of resorcinol, as did also a paper by HENRY MCCORMICK, of Chicago, called "The Extraction of Resorcinol From the Alkali Melt." Another paper by E. E. BRUNSKILL, of the Cincinnati Works (formerly Ault & Wiborg), discussed the Analids of Beta Oxy-napthonic acid.

The Qualifications of Organic Chemists was presented by L. CROSSLEY, chief chemist of the Calco Works, in which he, like Dr. Rose (and both Drs. Crossley and Rose have had wide experience as professors of chemistry before entering into industry), felt that so-called utilitarian work was of least value, while training in general principles in those studies which are necessary for the meditations of thoughtful men was of leading importance.

The same author, together with C. B. OGILVIE and G. S. SIMPSON, described a circulating burette provided with temperature control for making quantitative analyses of amines and noting the variations in shade produced by the decomposition of coupled products. Also an agitator for long-continued stirring of volatile liquids. Dr. Crossley also called attention to the explosion hazard of naphthalene vapors in the presence of SO_2.

Reports of the meetings dealing with Leather, Fuels, Fertilizers and Rubber, and an account of the visits to the various industrial plants will be published in subsequent issues.

First Meeting American Society for Steel Treating

First General Meeting of Amalgamated Societies Held in Philadelphia—Exhibit of Heat-Treating Equipment—Excursions to Many Important Industrial Plants—Abstracts of Some Technical Papers Presented

DURING the past few months, a movement toward the amalgamation of the Steel Treating Research Society—the pioneer organization of technical men in hardening rooms—and the younger and more vigorous American Steel Treaters' Society has been effected. Overtures for this desirable step were commenced by Prof. A. E. WHITE, of the University of Michigan, who easily convinced the influential men in each society that much duplication of effort could be avoided, needed funds conserved, and better progress made in all respects should these two organizations cease their sharp competition for support. As a disinterested third party, he was thus responsible for the merger which was finally confirmed by an overwhelming letter ballot of each society. It was therefore fitting that he should be unanimously elected president of the new society, the American Society for Steel Treating, at its first meeting, held last week in Philadelphia. T. D. LYNCH, of the Westinghouse Co., and T. E. BARKER, of the Miehle Printing Press & Mfg. Co., are vice presidents, while W. H. EISENMAN, the energetic secretary of the American Steel Treaters' Society, will occupy the same, but enlarged position. Directors are HOWARD J. STAGG, Halcomb Steel Co.; E. J. JANITZKY, Illinois Steel Co.; W. C. PETERSON, Packard Motor Car Co.; and FRANK FAHY, consulting engineer, New York.

A very creditable exhibition of apparatus used in heat treating was held by the society at the Commercial Museum. Many firms manufacturing tool and alloy steel; furnaces, refractories and fuel burning equipment; pyrometers and physical testing machines; quenching oils and carbonizing compounds displayed their lines, and were visited by many society members and guests. Some of the exhibits contained full-sized equipment in operation, a fact which influenced the comfort of the occasion materially. A dozen large gas furnaces produce more or less noise and considerable heat; the heat could be endured by most of the men—it felt like home—but the noise detracted very materially from the technical sessions: often it was absolutely impossible for the speakers to be heard by those at the rear of the hall. Yet despite this regrettable fact, the eight technical sessions were quite well attended and the papers were followed with extreme attention. Several of the more interesting contributions are abstracted on the following pages.

Messrs. SAUVEUR, RICHARDS and VAUCLAIN formed the attractions at the banquet. Dr. RICHARDS spoke on "The Ancient and Honorable Art of Steel Treating" and cited evidence to support his view that iron and steel were discovered even earlier than bronze. By virtue of his skill in making tools and weapons the smith and armorer have always held a most honorable position among craftsmen. Dr. RICHARDS, together with Prof. SAUVEUR, ventured the hope that the new society would add much luster to the ancient prestige by adding newly discovered science to the heat-treaters' equipment. Prof. SAUVEUR even went further in citing the fact that whereas steel-metallurgy has been revolutionized in the last three centuries by the labors of a galaxy of French

and English masters, the efforts of Americans have largely been confined to the introduction of grand labor-saving devices, and the procurement of tremendous tonnage. Yet the new society, in emphasizing quality as its prime aim, should have a great influence in the future development of substantial advances in steel metallurgy; an advance which is pacing civilization.

Some of the Technical Papers

Heat-Treating Small Alloy Steel Parts

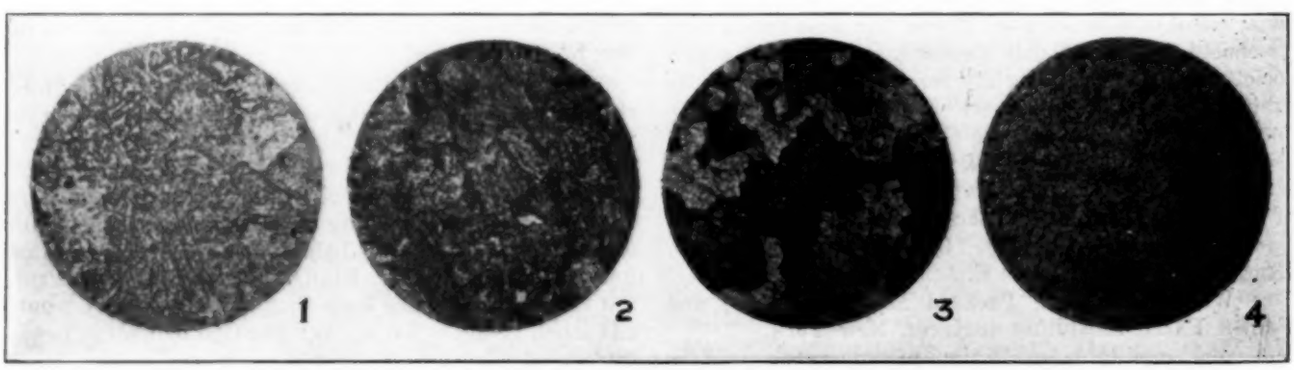
A method of heat-treating small high-carbon or chromium-vanadium steel parts in quantity for maximum hardness and strength was described by R. L. Gilman, of the Standard Steel & Bearing Co. He uses three rotating tube furnaces, connected in series, with the necessary quenching tanks and conveyors between, so that the operation is continuous and requires no manual labor. The furnaces are gas fired, with automatic regulation for close temperature control. Parts are charged into the cold end of the carburizing furnace at the rate of 150 lb. per hr., together with crushed charcoal. These work their way forward so that at the end of 30 min. they attain a low red heat. A mildly carburizing atmosphere is maintained by illuminating gas from municipal mains. Gradually the pieces attain about 1,600 deg. F., and at the end of two hours drop out of the end of the furnace into circulating oil. A conveyor quickly removes them at a smoking heat to boiling soda solution for cleaning, and thence to the hardening furnace at a uniform temperature. This furnace is heated to a considerably higher temperature (1,750 deg.) than the piece attains, owing to its short stay—6 or 7 min. is sufficient for $\frac{5}{8}$-in. work to reach the hardening temperature superficially. Quenching and annealing follow, a similar furnace practice being used. Small pieces of correct shape, such as many bearing parts, may be safely treated in this manner, which gives extreme uniformity of surface hardness and finish. Subsequent operations may proceed with sufficient precision and speed to pay amply for the long carburization period.

Heat-Treatment of Chromium-Nickel Steel Spindles

Details of the heat-treatment given chromium-nickel steel spindles for automatic screw machines were given by H. B. Smith and F. J. Olcott, of the New Britain Machine Co. S.A.E. Steel 3440 (Fig. 1) is delivered in $5\frac{1}{2}$-in. rounds, and forged to $3\frac{1}{2}$ in. at temperatures from 2,000 to 1,600 deg., giving the microstructure of Fig. 2 after air cooling. Four thousand pounds of forgings is then loaded into a car-type furnace at 600 deg. F., and in twelve hours is heated to 1,600 deg. Doors are then opened and the charge removed after it has cooled to 600. Annealing is done in a similar furnace. Seven hours is required to reach 1,380 deg.; the furnace is then sealed, and in four hours has dropped to 600 deg., when the charge is removed. Maximum allowable Brinell hardness is 200, and the structure is as shown in Fig. 3. After machining into a hollow tube $3\frac{1}{8}$ x 32 in., with $\frac{1}{32}$-in. walls, the spindle is hardened in a lead pot, 8 in. diameter by 54 in. deep, containing 450 lb. lead at 1,400 deg. F. One spindle is immersed, lowering the lead to 1,375, which temperature gradually increases, reaching 1,400 in 10 min., when the spindle is oil quenched. Drawing is done in an electric furnace at 400 deg. F., automatically controlled to within 7 deg. plus or minus, 80 min. being required. Fig. 4 reproduces the structure; minimum hardness is 418. Finish-grinding with a soft wheel, slow feed and plenty of water will produce no soft spots, in fact total rejections over a period of two years amount to but 1 in 700. Hardening warps some pieces as much as 0.05 in. out of line; this is corrected under a press, but is a feature which requires further study for its elimination.

Hardening Tractor Worms

J. L. McCloud described some interesting results obtained at the Ford Motor Co. in the routine of hardening tractor worms. As a result of preliminary work on rather an extensive scale, they became convinced that the best combination of machining qualities, high physical properties, ease in heat treatment and grinding could be had from oil-hardening gear stock (carbon 0.42 per cent, Mn 0.85, Cr 0.90, Ac 1,450 deg. F., Ar 1,280 deg. C.). By the use of a continuous furnace the annealing and normalizing time was reduced from 12 hr. to $2\frac{1}{2}$ hr.; the furnace, although only three times as large as the intermittent type, handles six times the work, or 1,900 lb. per hr. Normalizing consists in bringing the steel to 1,575 deg. F., where it remains long enough to relieve all forging strains and to place all carbide in solution; then it is cooled at a definite rate just below Ar, then quenched in boiling water. Machinability is found to be a function of the Brinell hardness, which is therefore held between 179 and 207. After finishing, the gear is heated in a salt bath (50 per cent Na_2CO_3, $37\frac{1}{2}$ per cent NaCN and 12 per cent NaCl). It requires 10 min. to reach 1,540 deg. C.; after remaining 6 min. longer it is quenched in oil; the resulting Brinell hardness is about 500, both at edge and center. Its ductility, however, is low—the elastic limit and ultimate are prac-



FIGS. 1. to 4. CHROMIUM-NICKEL STEEL IN SPINDLE
All etched by NHO_3 in alcohol. × 70.

Fig. 1. As received. Fig. 2. Unannealed forging. Fig. 3. Annealed forging. Fig. 4. Finished spindle.

tically the same. If now the hardened steel worm is plunged into another salt bath at 1,470 deg. F. for 12 min., its temperature at the center will reach 1,375 deg. F.; upon second quenching the hardness in the tooth section will still be 500 but at the center it is reduced to 340, while the ductility is immeasurably improved (e. l. 60,000 lb., ult. 100,000+ lb.).

Quenching Mediums

V. E. Hillman, metallurgist of the Crompton & Knowles Loom Works, discussed "The Efficiency and Applications of Various Quenching Mediums." He defined the main useful characteristics of oil to be five: First, the hardening efficiency, measured by the Brinell number of a coupon after quenching from a proper temperature; second, the quenching uniformity, or the production of substantially equal hardness despite material variations in oil temperature; third, the viscosity, which as it increases, increases the difficulty of circulation and reduces the hardening efficiency; fourth, the flash point, which must be high from a safety standpoint; and fifth, the permanency under constant use. While practically all oils when used as quenching baths act in the same way when new, when maintained at a uniform temperature, and when used as a still bath, animal oils in general have a good hardening efficiency, but deteriorate rapidly in use and vary much in quality shipment to shipment. Vegetable oils also give good hardness, but are liable to deteriorate through oxidation. Mineral oils, while subjected to some fractional distillation in continuous quenching duty, are excellent in service not too severe. Compounded oils of good repute are on the market which overcome many of these difficulties.

Peace-Time Uses of War-Time Lessons

A clear account of some "Lessons Learned in the Manufacture of Munitions and Ordnance That Can Be Applied to the Peace-Time Pursuits of Industry" was given by F. V. Larkin, head of the department of mechanical engineering, Lehigh University. Tracing the manufacture of projectiles and gas cylinders from the furnace to the finished state, he remarked that if the furnace operators will compile an accurate history of every open-hearth heat, many mysterious "off-heats" may be easily explained and become much less frequent. Proper attention to pouring, giving a smooth, clean surface on the ingot, followed by careful rolling-mill practice will reduce chipping or grinding of surface defects in the blooms down to zero. Pyrometric control of forge furnaces gives more uniform heat, reducing wear on tools and the number of rejections. Heat treaters should know enough about pyrometers to regard them as aids in their work rather than telltales. Time was demonstrated to be an important factor here—continuous furnaces were operated on the stroke of a gong, effecting remarkable results in volume and quality of production. Turning to the human side of the work, Prof. Larkin emphasized that with the right spirit in a new organization, the existence of unknown trade secrets is a spur to accomplishment rather than a handicap, and he knew of no secret process which could not be bettered by proper study and execution. Specifications, too, if properly drawn and fairly met, cannot but work to the advantage of the workmen, establishment and product. Never ask a customer whether a product will do. Know that it is right, and then he will have to take it.

Manufacture of Stainless Steel Articles

Certain metallurgical features of the manufacture of stainless steel articles were given by W. H. Marble, manager of the American Stainless Steel Co. An analysis of C 0.20 to 0.40 per cent, Cr 13 per cent, Si 0.30 per cent and Mn 0.50 per cent has been all but standardized. Carbon must be above 0.20 per cent for necessary hardness, yet not above 0.40, else difficulty will arise in forging. Silicon tends to neutralize the hardness of carbon, yet enough should be present to insure soundness. Chromium is the essential element furnishing the peculiar resistance to corrosion, tungsten and nickel being sometimes added for an increasing luster in polish. Freedom from corrosion is independent of the surface shape and smoothness as long as it is clean and not cold-worked. In practice, however, a polished surface insures cleanliness. Stainless steel is manufactured much like high-speed steel. Ingots are box-annealed at 1,380 deg. F., air-cooled, reheated to 2,100 deg., and hammered carefully, never allowing the temperature to drop below 1,650 deg. F. Cooling after forging gives hard material, the higher the uninterrupted cooling the harder. Rough forgings are now re-annealed at 1,380 deg. F., using all the precautions necessary for high-grade steel; furnace-cooled to 1,100, and then air-cooled—resulting in Brinell hardness, 200. After machining and finishing the piece may be hardened from 1,750 in air, oil or water, depending upon the intricacy of the shape, and tempered at a suitable heat, varying from 280 deg. F. for knife blades to 1,100 deg. F. for exhaust valves. One early trouble in using this material in the cutlery trades occurred here, since the temper colors appear at approximately twice the temperature indicated by plain carbon steels.

Helical Springs for Heavy Duty

Unusual springs of particularly heavy duty are required to transmit the power from a motor-driven quill, through a flexible coupling to the driving wheels of heavy electric locomotives. T. D. Lynch, of the Westinghouse Co., presented a tentative specification for manufacture of such helical springs, or indeed, for higher grade locomotive springs than those now available.

He favors an analysis as follows:

Carbon	0.50 to 0.60
Manganese	0.60 to 0.80
Silicon	1.90 to 2.20
Phosphorus	0.04 Max.
Sulphur	0.04 Max.

It should be made by crucible or electric furnace, cast in 9-in. ingots with smooth surface, free of surface blemishes. Such steels must be reheated very slowly; rolling temperature is 1,100 deg. C. After careful reduction to 3-in., the billet is cooled, cropped thoroughly, and any surface defect chipped or ground out. Reheat to 1,100 deg. C., roll to size (in this case 1 in. ± 0.025), shear, cool, inspect and carefully bundle so that no scratch or nick may mar the finished surface. In spring making, the rods are coiled on a hot mandrel after heating to 925 deg. C. Allow no water to come in contact with spring or mandrel; notch for length at a dull red heat, cool slowly and uniformly. All operations should guard against producing the slightest surface damage. Recommended heat treatment: preheat to 700 deg. C., soak at 900 deg. C., quench in light oil; draw in salt bath at 455 deg. C., and finally clean in a hot soda wash, followed by an oil dip to prevent corrosion. Bri-

nell hardness should be between 375 and 450; structure troostitic or troosto-sorbitic; tensile strength 200,000 lb. per sq.in. or more. The specification covering reaction under load depends upon the use to which the spring is to be put.

Highly Resistant Alloy Steel

Charles M. Johnson, director of research department, Crucible Steel Co., described the "Properties and Microstructure of Heat-Treated Non-Magnetic, Flame-, Acid- and Rust-Resisting Steel." The analysis was not given, but the statement was made that the carbon was 0.3 to 0.4, and micrographs of ingot structure indicate it to be a complex alloy which reverts to a homogeneous solid solution upon annealing at 1,300 deg. C. (Brinell 160), and upon very long-continued tempering—a matter of days—allows an excess constituent to divorce itself and become spheroidized. It is quite non-magnetic—its residual magnetism after charging did not exceed four lines per sq.cm. It resists staining and rusting remarkably; the resistance to corrosion being compared with other well-known steels as follows, the figures representing loss in grams per sq.in. in 24 hr.:

	Glacial Acetic	10% H_2SO_4	32% HNO_3	19% HCl
New steel	6.1	3.2	0.4	33.3
Monel metal	0.7	1.3	soluble	13.1
High Cr-Si steel	0.0	soluble	0.5	
38 per cent Ni steel	13.8	4.1	soluble	19.0
High Cr steel	0.7	soluble	0.1	soluble

Approximate physical results on the new steel are as follows:

	E. L.	Ult.	Elong.	Reduc.	Brinell
Heated 5 min. at 2,400 F.	90,000	120,000	30	45	230
Quenched in oil from 2,000+ F.	60,000	110,000	50	60	200

Although the metal can be forged, rolled or sheared in thicknesses 0.1 to 1 in., and is machinable, it offers a maximum resistance to prolonged heating at temperatures up to 2,000 deg. F. and is cut by the oxy-acetylene torch with the utmost difficulty.

Blades for Power Shears

Aside from the hand and machine tools required in their extensive shops, a modern steel plant requires much tool-stock for shear blades and pneumatic chisels, the latter for chipping surface defects from high-grade billets. George Porteous, of the Minnesota Steel Co., called attention to the fact that a high-grade open hearth steel analyzing C 0.90 to 1.00, Mn 0.30 to 0.40, Si 0.02, P 0.01, S 0.03, can be used successfully for such service with better economy than crucible or alloy steels costing at least four times as much. He described in his paper precautions to be observed in the forging and hardening of pneumatic tools, drills, taps and reamers. Fig. 5 shows some of the tools, as well as two pairs of shear blades, the larger for billets and the smaller one for rounds. A pair of the latter were exhibited and were in excellent shape, even after having cut 20 tons of cold 1¼-in. rounds of 1.20 carbon, 0.70 manganese steel. These blades are carefully forged, furnace annealed at 1,475 deg. F., machined and hardened at 1,450 deg. by quenching in water to harden the surface, then transferring the still hot piece to oil. Drawing temperature is 490 to 500 deg. F. If the bolt line through the center of the blade is kept tough by protecting with bolts, washers and strips during the heat-treating operations, as shown at the right of Fig. 5, no breaks at this weak section will occur either during fabrication or service.

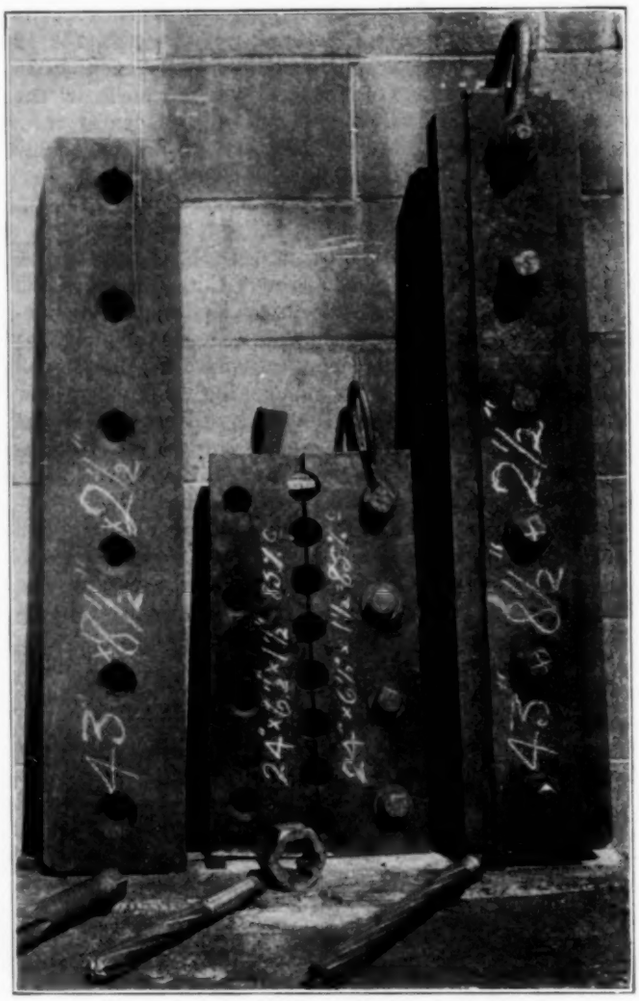


FIG. 5. TOOLS MADE OF OPEN-HEARTH STEEL

Cyanide Hardening Due to Nitrogen

G. R. Brophy and S. B. Leiter, of the General Electric Co., have discovered that whereas pearlite due to carbon and pearlitic structure due to nitrogen are indistinguishable after picric or nitric acid etching, Stead's cupric reagent darkens the former very slightly but turns nitride black. Using this test, cyanided cases were found to contain much nitrogenized material. They therefore conclude that absorption of nitrogen is responsible for the properties of articles case hardened in cyanide, as well as the carbon, which latter had formerly been thought the preponderating cause. If a bar containing 0.04 per cent carbon be immersed four hours, the resulting surface will analyze only 0.33 per cent carbon, yet it will easily resist a file. Quenched 30-point steel Brinells 207, but the cyanided bar is hard to file even after annealing. Further confirmation of the authors' ideas is found in the fact that if a cyanided case be ground off, the rod is still very brittle, and remains so after ordinary annealing.

Acknowledgment

Through an oversight in the article on "Problems of the Petroleum Industry," by William A. Hamor, page 425 of the Sept. 8 issue, we failed to acknowledge the courtesy of the Petroleum Iron Works Co., Sharon, Pa., in supplying the author with photograph reproduced in Figs. 2, 3 and 4, illustrating stills and agitators manufactured by that concern.

Studies in Evaporator Design*—IV

An Investigation of the Boiling Points of Salt Solutions—Critical Examination of the Vapor Pressure and Temperature Data Given in the Literature, Checked by Determinations—Charts and Tables on Salt Solutions

BY W. L. BADGER AND E. M. BAKER

AS A part of the extensive program of research, undertaken in the Evaporator Experiment Station of the University of Michigan, on heat transmission in evaporators and the various factors affecting evaporator design, a study is being made of the loss in effective temperature drop between heating steam and boiling liquid, due to excess boiling point of the solution being evaporated. To this end it has been found necessary to attempt to collect all possible data on vapor pressure-temperature curves at varying concentrations of the more important chemicals recovered from solution in the industries, and where information is not available or is of doubtful value, to determine the necessary data in this laboratory. This paper particularly concerns an investigation of such curves for sodium chloride, and a critical review of such data contained in the literature.

ELEVATION OF BOILING POINT WITH SALT CONCENTRATION

In the design of an evaporator installation, it is necessary to know the "excess boiling point" of the solution being evaporated in each effect, at the temperature and pressure existing in that effect, in order to be able to calculate the heating surface required in any given case. This so-called "excess boiling point" is merely the elevation of the boiling point of the solution over the boiling point of pure water at the given pressure. The difference between the temperature of the steam supplied to the evaporator, t_1, and the temperature of the vapor coming from the solution, t_2, may be divided into three parts:

a. Loss of effective temperature drop due to the excess boiling point of the solution.

b. Loss of effective temperature drop due to the effect of hydrostatic head.

c. Temperature drop available to cause heat transference from the steam to the boiling solution.

Hence, the available or effective temperature drop may be much less than the total temperature drop, since $c = (t_1 - t_2) - (a + b)$.

For example, a saturated solution of NaCl will boil at 108.7 deg. C. under a pressure of 760 mm. mercury, while water boils at 100 deg. C. If steam at 115 deg. C. were used to cause evaporation of water, and also of a saturated NaCl solution, in evaporators operating under 760 mm. pressure, there would be an effective temperature drop (neglecting for the moment the hydrostatic head losses) across the heating surface of only 6.3 deg. C. in the case of the salt solution, as compared with 15 deg. C. in the case of water or a solution that does not have an excess boiling point. Moreover, the heat transmission per degree temperature drop per square meter of heating surface will be much less the smaller the temperature drop.[1] The excess boiling point represents a loss of temperature drop, which means loss of evaporator *capacity*, not of thermal efficiency of the set of pans.

DIRECT DETERMINATIONS REQUIRED

While the literature shows a large number of determinations of elevation of the boiling points of aqueous solutions, many of these are for dilute or only moderately concentrated solutions, or are at atmospheric pressures. On critical examination, many of the values given are found to differ widely. Hence this laboratory has undertaken the rather ambitious program of examining the values given in the literature, and of making such determinations as may be necessary to prepare tables of sufficient range and accuracy for the purpose of evaporator design.

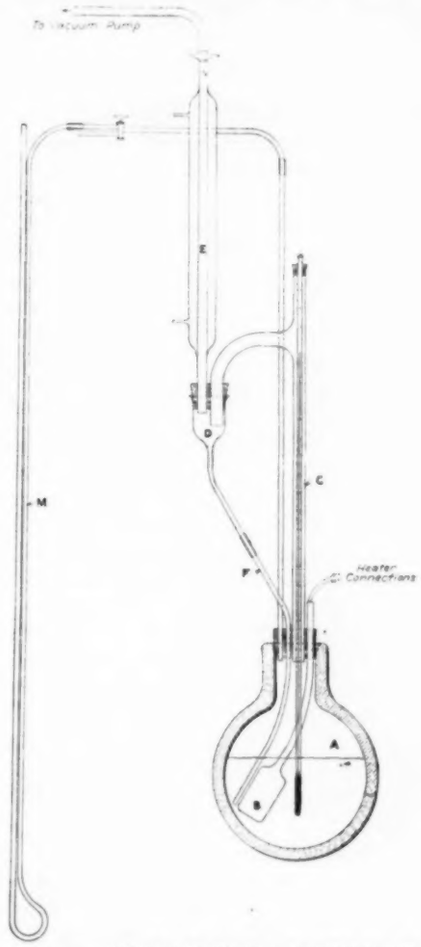
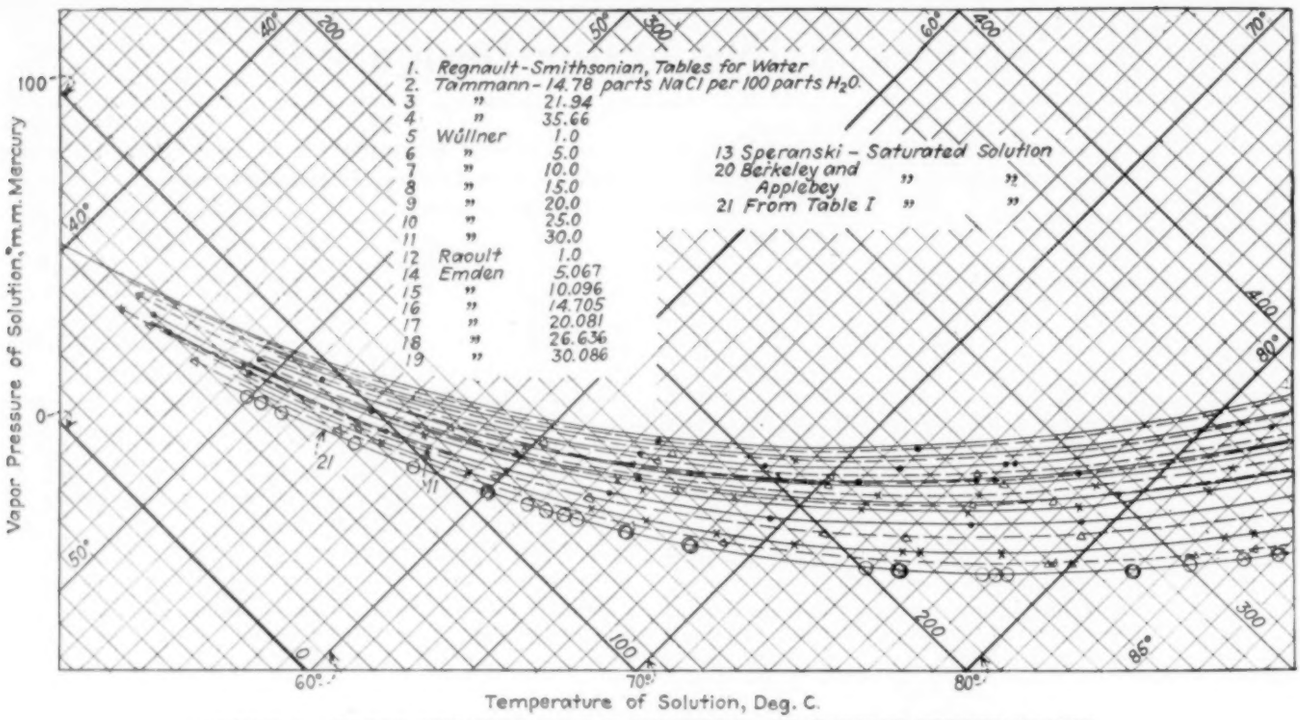


FIG. 1. BOILING-POINT APPARATUS

*Read before the American Institute of Chemical Engineers, Montreal, June 29, 1920.

[1] See "Studies in Evaporator Design—I," CHEM. & MET. ENG., vol. 23, No. 6, Aug. 11, 1920, p. 237. The relation of temperature drop and temperature level to heat transference in the vertical tube evaporator.


1. Regnault-Smithsonian, Tables for Water
2. Tammann - 14.78 parts NaCl per 100 parts H_2O
3 " 21.94
4 " 35.66
5 Wüllner 1.0
6 " 5.0
7 " 10.0
8 " 15.0
9 " 20.0
10 " 25.0
11 " 30.0
12 Raoult 1.0
14 Emden 5.067
15 " 10.096
16 " 14.705
17 " 20.081
18 " 26.636
19 " 30.086
13 Speranski - Saturated Solution
20 Berkeley and Applebey " "
21 From Table I " "
Vapor Pressure of Solution, m.m. Mercury
Temperature of Solution, Deg. C.

CURVE 1. VAPOR PRESSURE OF NaCl SOLUTIONS AT VARIOUS TEMPERATURES

The first problem to be studied has been the excess boiling point of sodium chloride solutions. This was taken up with the intention of later testing our theories by actual test on salt pans regularly in operation.

It should be pointed out here that it is impractical to calculate elevation of boiling point or depression of vapor pressure from the physicochemical considerations. Many of the laws, as Raoult's, hold rigidly only for ideal solutions. Equations and formulæ have, however, been advanced which attempt to take into consideration all the factors involved, but these, at least from the engineering standpoint, are impractical. It is evident that for exact application of such formulæ a knowledge of the degree of dissociation of the solute and of association of the molecules and ions of the solute with the solvent must be known over the entire range of concentrations and pressures. Much of the theoretical work has attempted to establish a quantitative relationship between the boiling points of solutions and osmotic pressure. Some excellent work of Dr. Orin E. Madison on the theory of osmose, not as yet published,[2] shows that such relations cannot be expected to hold rigidly in the case of electrolytes. It therefore seems unprofitable to go into a theoretical discussion of these factors in this paper, but a bibliography of articles dealing with this question and methods of determining boiling points is appended.

The direct determination of the vapor pressure of the solution under the desired conditions of temperature and pressure either by the static or ebullistic methods is far more satisfactory than an attempt to get at it from theoretical considerations or empirical formulations.

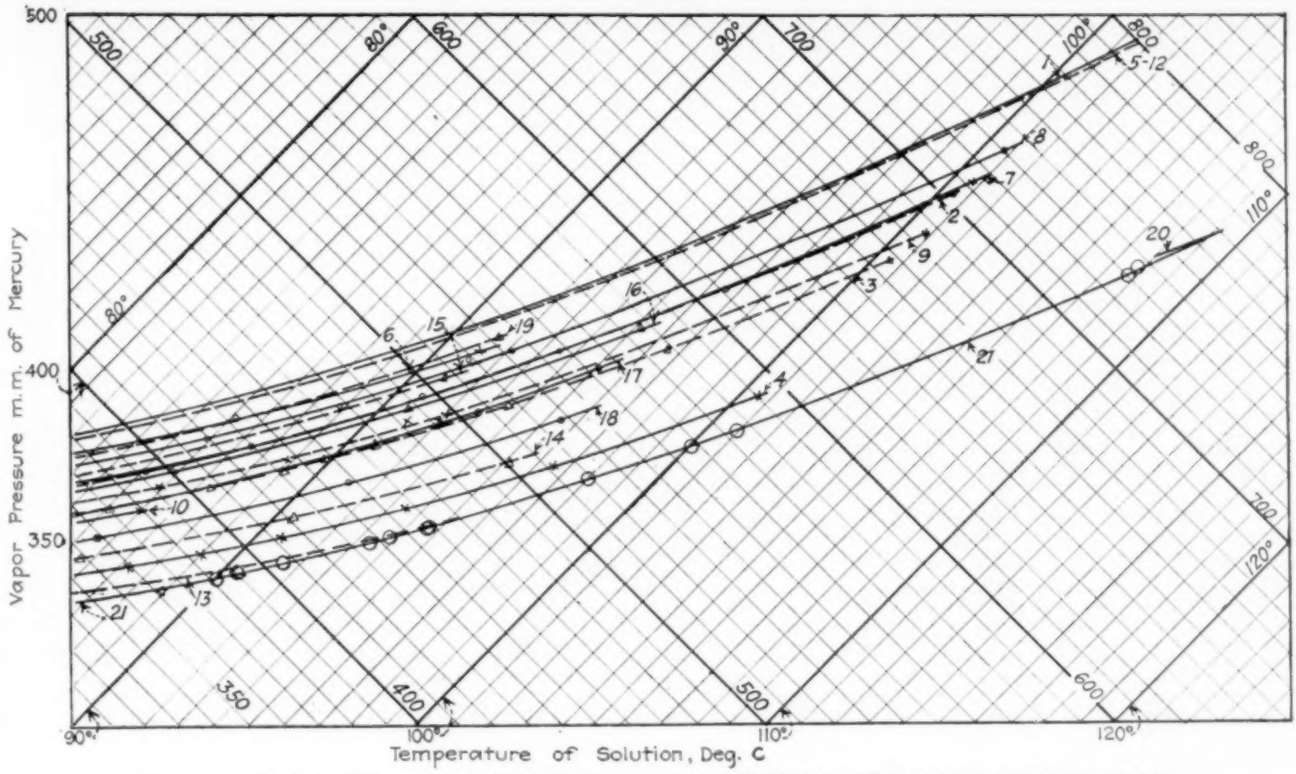
The work on sodium chloride was therefore divided into two parts: first, a determination of the boiling point of saturated sodium chloride solution over the temperature range 50 deg. C. to the boiling point at 760 mm. pressure, to supplement the values found in the literature, and second, a critical study of the values given for the boiling points (or vapor pressures) of salt solutions of various concentrations over the range of temperatures and pressures employed in evaporator practice.

Boiling Point Apparatus

Several types of boiling point apparatus were experimented with, but the apparatus finally used is shown in Fig. 1. The drawing is nearly self-explanatory. A saturated solution of sodium chloride, together with an excess of salt, was placed in the 2-l. flask *A*, which was protected from radiation and air currents by a layer of asbestos ½ in. thick, molded onto the flask. The solution was heated by the small electric heater *B*. The amount of heat input, or rate of boiling, was regulated by varying the current by means of an external resistance in series with the heater. The vapor passed up around the thermometer through the tube *C*, which was also protected with asbestos covering, except at the point where temperatures were being read, thence to the trap *D* and the condenser *E*. All condensed water was returned to the flask at the base of the heater by the tube *F*. By thus steam-jacketing the thermometer, the steam correction to the reading taken was reduced to 0.12 deg. C. for the maximum correction for the temperature of the emergent stem. The vacuum was measured by the U manometer *M* which communicated directly with the flask, thus measuring the pressure at a point very near the thermometer bulb. The importance of this precaution is well shown by E. von Rechenburg.[3] The vacuum was maintained and regulated by means of an ordinary laboratory water jet vacuum pump. In this way it was possible to hold the vacuum steady within 1 to 2 mm. for periods of over 30 min., during which a number of simultaneous readings of vacuum and temperature could be taken. The vacuum readings were corrected for the temperature of the mercury, before subtracting from the barometer to give the absolute pressure. The thermometer used for the readings below 100 deg. C. was graduated in tenths of degrees, and the thermometer

[2] By personal communication.

[3] *J. prakt. Chem.*, vol. 79, p. 475.



CURVE I (CONTINUED). VAPOR PRESSURE OF NaCl SOLUTIONS AT VARIOUS TEMPERATURES

used for the higher temperatures was graduated in fifths of a degree. These were both certified thermometers, which had been rechecked at the boiling point of water. It should be remembered that the values were wanted for engineering design, and that an accuracy of 0.1 deg. C. or 2 mm. of mercury would be amply accurate for this purpose.[4] The values so obtained are given in Table I. This table also includes some values obtained with essentially the same apparatus, but with different methods of heating. In one case the heating was done by a small copper coil placed in the solution and heated by means of steam, and in the other case direct heating by a gas flame was used.

TABLE I. VAPOR PRESSURE OF SATURATED SALT SOLUTIONS

Experimental Values

Mean Values of Temp. of Solution Deg. C.	Vapor Pressure mm. of Mercury	Number of Readings Averaged to Give Mean Values Cols. 1 and 2	Mean Values of Temp. of Solution Deg. C.	Vapor Pressure mm. of Mercury	Number of Readings Averaged to Give Mean Values Cols. 4 and 5
107.90	735.7	20	78.16	239.3	3†
107.80	731.6	40	77.87	236.7	4
108.84	575.0	2*	75.30	213.5	10
99.90	558.0	5*	75.23	212.1	10
97.92	518.7	3*	73.98	201.5	4*
94.68	456.9	10	68.11	155.3	7
94.66	458.0	10	68.04	154.0	7
93.83	444.9	4*	65.85	139.0	10
93.39	437.3	3*	65.70	138.3	10
91.37	406.0	3*	63.85	127.0	9
90.38	391.8	4†	63.36	123.9	7
90.02	381.5	10	62.73	120.2	5
89.98	381.0	10	61.82	116.7	10
86.36	331.6	10	60.27	109.6	5*
86.24	329.9	10	60.05	108.4	10
85.13	319.5	8†	57.38	92.9	20*
83.66	301.5	6*	54.79	84.2	4*
82.44	281.9	7	51.59	70.0	7
82.25	280.3	12	50.61	67.7	5
78.56	242.5	9	50.04	64.8	4*

*Heating by direct heat.
†Heating by steam coil.
Other values heating by electrical heater.

The Literature on Vapor Pressures and Boiling Points

The study of the values given in the "standard" tables and scattered through the literature was carried out as follows: The data could be separated for the most part into two divisions: (*a*) the vapor pressure of certain NaCl solutions over a range of temperatures, and (*b*) the boiling point of various NaCl solutions at 760 mm. pressure. Curves I and II were then plotted on a very large scale. Curve I shows the value given for the vapor pressure of NaCl solutions over a range of pressures. Values below 50 deg. C. were discarded as not being pertinent. Smooth curves were drawn through the points given by each investigator. Our results for saturated sodium chloride solutions were included in this graph. From Curve I a table was made up showing for each 5 deg. interval, from 50 to 100 deg. C., the concentration of sodium chloride and the corresponding vapor pressure given by each investigator.

Curve II shows various concentrations of NaCl solutions plotted against their boiling points under 760 mm. pressure. Some of the points at the same concentration differ by over 2 deg. C.[5] At this point it was found necessary to know the solubility of NaCl at different temperatures. For this purpose Curve III was plotted

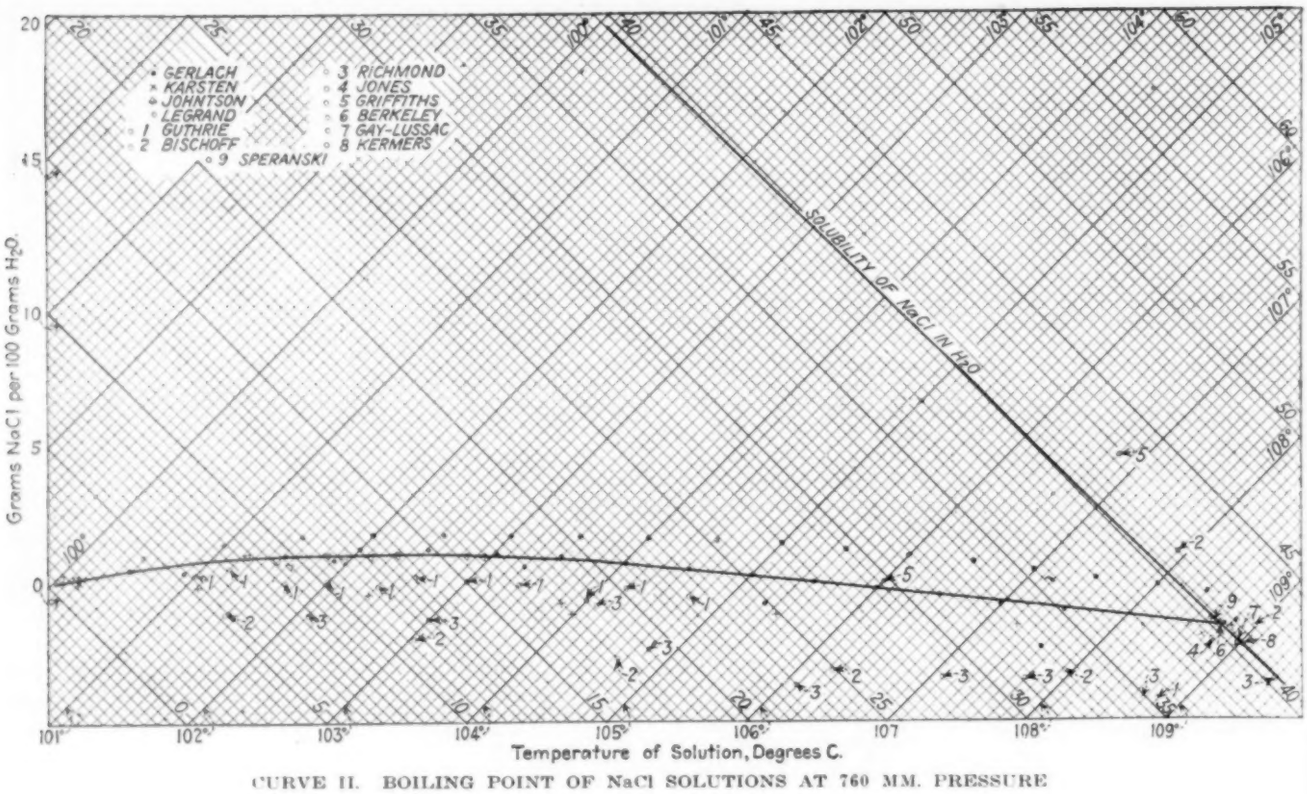
TABLE II. SOLUBILITY OF NaCl IN H_2O

Values Read from Curve III

Temperature, Deg. C.	Grams NaCl Dissolved by 100 g. H_2O at Temp. *g.*	Temperature, Deg. C.	Grams NaCl Dissolved by 100 g. H_2O at Temp. *g.*
50	36.95	101	39.80
55	37.05	102	39.88
60	37.30	103	39.93
65	37.55	104	40.00
70	37.85	105	40.08
75	38.12	106	40.15
80	38.40	107	40.23
85	38.70	108	40.30
90	39.00	109	40.37
95	39.30	110	40.45
100	39.70		

[4] Many values given in the literature were found to differ by two full degrees C., even though pressures were expressed in hundredths of millimeters and temperatures in thousandths of a degree.

[5] The values given by Droop Richmond, Gmelin-Kraut, 7th ed., vol. 3, p. 359, should be for per cent NaCl instead of g. NaCl per 100 g. H_2O.



CURVE II. BOILING POINT OF NaCl SOLUTIONS AT 760 MM. PRESSURE

showing grams NaCl dissolved by 100 g. H_2O at various temperatures as given by different investigators. A smooth curve was drawn, and this curve was taken as giving the true solubility of NaCl in H_2O. Values read from this curve are given in Table II. These values were also plotted on Curve II, and a smooth curve was then drawn through the values previously plotted, and extending just up to this solubility line. In drawing Curves II, III and IV an effort has been made to weight the values according to the care, accuracy and date of the original investigations.

Vapor Pressure of Salt Solutions

Curve IV was next plotted from data obtained from Curves I and III. That is, for each 5-deg. interval, from 50 to 100 deg. C., the vapor pressures of solutions of concentrations ranging from pure water to saturated solution were plotted against the corresponding concentrations. The concentration for the saturated solutions was taken from Curve III. The 100 deg. C. curve was supplemented by values given by Tammann for the vapor pressures of salt solutions at 10 deg. C., these data being plotted as solid circles. Smooth curves were drawn through these points, thus giving mean values for the vapor pressure of solutions of various concentrations at 5 deg. temperature intervals. Table III, showing the

TABLE III. VAPOR PRESSURES OF SODIUM CHLORIDE SOLUTION

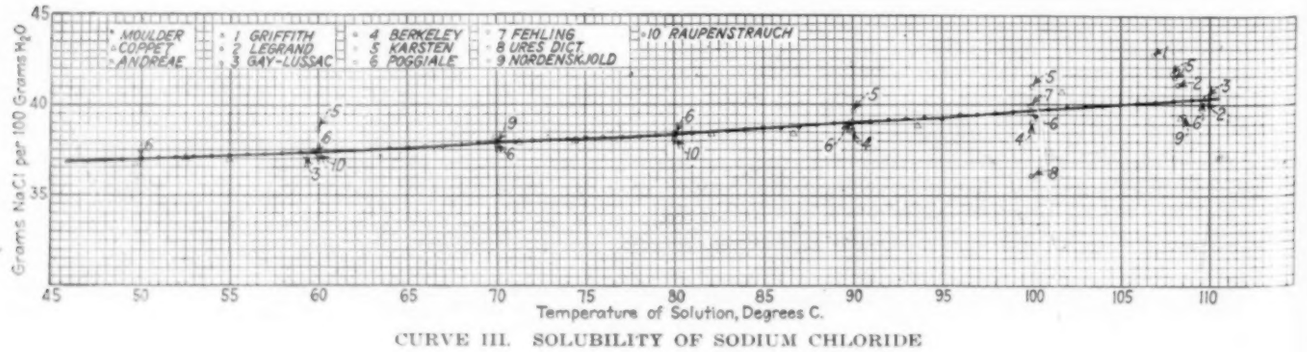
Values Read from Curve IV

Grams NaCl per 100 g. H_2O	Vapor Pressure of Solution at Temperature of 50 Deg. C.	55 Deg. C.	60 Deg. C.	65 Deg. C.	70 Deg. C.	75 Deg. C.	80 Deg. C.	85 Deg. C.	90 Deg. C.	95 Deg. C.	100 Deg. C.
0	92.0	117.5	148.8	186.9	233.1	288.5	354.6	433.0	525.4	633.8	760
4	90	115	145	183	228	282	347	423	513	620	743
8	88	113	141	178	220	275	338	412	500	605	725
12	86	110	138	174	217	268	329	401	487	589	769
16	84	107	134	169	211	261	320	390	474	573	687
20	81	103	130	163	204	252	310	379	460	555	666
24	78	100	126	158	197	244	300	366	444	537	646
28	75	96	121	152	190	234	289	353	428	519	624
32	71	92	116	146	182	226	278	339	412	500	602
36	67	87	110	139	174	216	267	325	395	481	580
Saturated Solutions: Grams NaCl per 100 g. H_2O	36.95	37.05	37.30	37.55	37.85	38.12	38.40	38.70	39.00	39.30	39.70
Vapor Pressure	66	86	108	137	170	212	261	316	383	465	559

TABLE IV. TEMPERATURE AT WHICH NaCl SOLUTIONS HAVE A VAPOR PRESSURE OF 760 MM.

Values Read From Curve II.

Grams NaCl per 100 H_2O	Temperature of Solution, Deg. C.	Grams NaCl per 100 H_2O	Temperature of Solution, Deg. C.
0	100	24	104.6
4	100.6	28	105.6
8	101.2	32	106.6
12	102.0	36	107.0
16	102.8	40.37 (Sat.)	108.7
20	103.7		



CURVE III. SOLUBILITY OF SODIUM CHLORIDE

vapor pressure at these temperatures of solutions of various concentrations, was then made up by reading values from Curve IV. Table IV, derived from Curve II, shows the temperature at which solutions of various concentrations have a vapor pressure of 760 mm. From these values Curve V was plotted, which shows the vapor pressure, at different temperatures of water, of solutions containing 4, 8, 12, 16, 20, 24, 28, 32 and 36 g. NaCl per 100 g. H_2O and of saturated NaCl solution. It is noteworthy that smooth lines, conforming in curvature with the curve for pure water, could be drawn through *every* point so plotted. From this it is inferred there could be no great error in the values given by either Curves II or V.

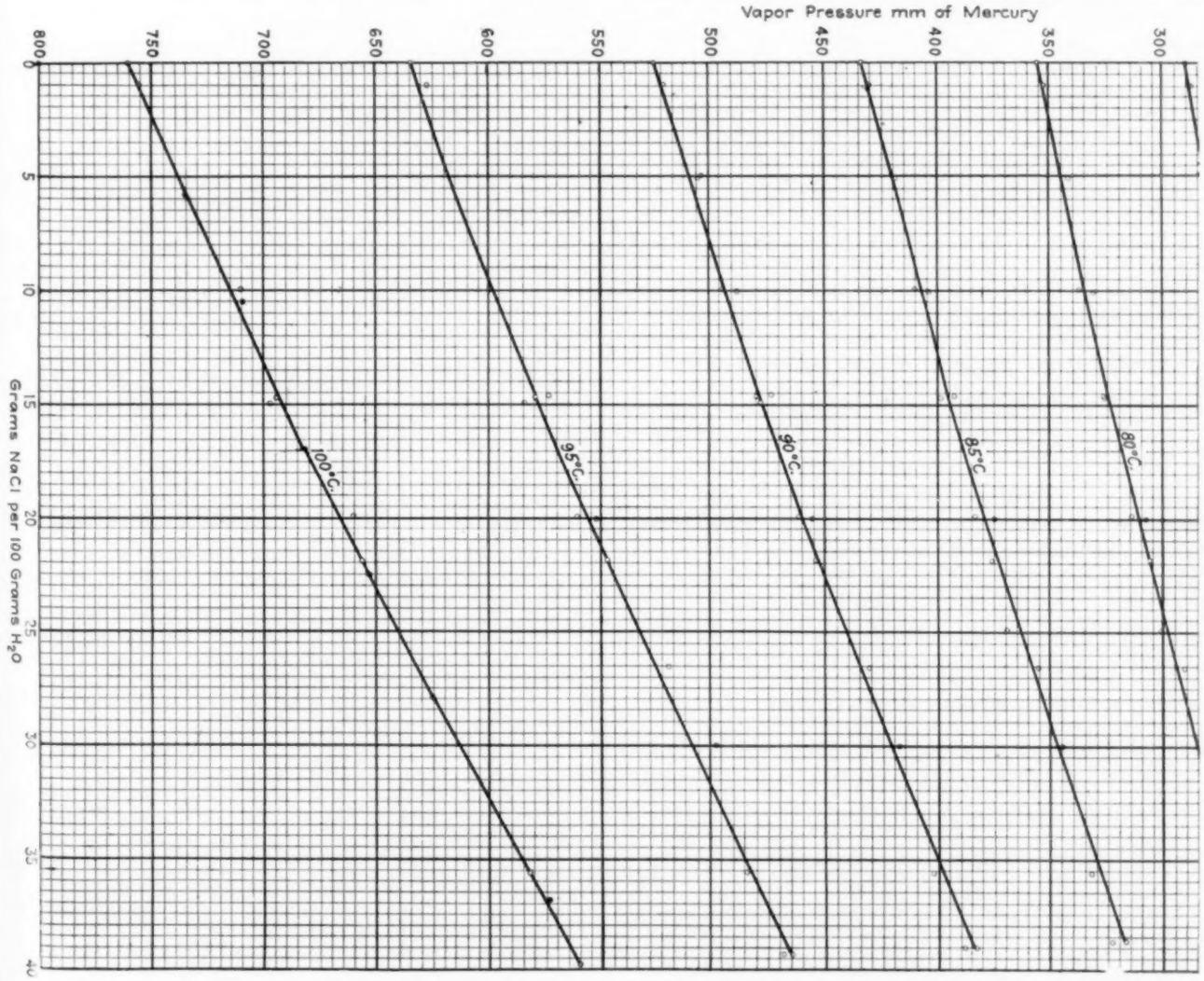
Temperature Heads

Curve V is useful in giving a close approximation of the temperature drop available for heat transference in a salt pan. The temperature of the vapor coming from the solution in any effect is the temperature at which water would boil under the pressure P_1, existing in that body, and hence may be read from the curve, $G = 0$ (call this temperature t_1). Now if the mean hydrostatic head, expressed in mm. of mercury, is added to P_1, the mean total pressure in the boiling liquid, P_2, is obtained. On Curve V follow over the pressure P_2 until the particular concentration of salt existing in the pan is reached. The abscissa corresponding to this point gives the mean temperature, t_2, at which the solution boils. The difference between these two temperatures, $t_2 - t_1$, is temperature drop lost due to excess boiling point and hydrostatic head. The difference between

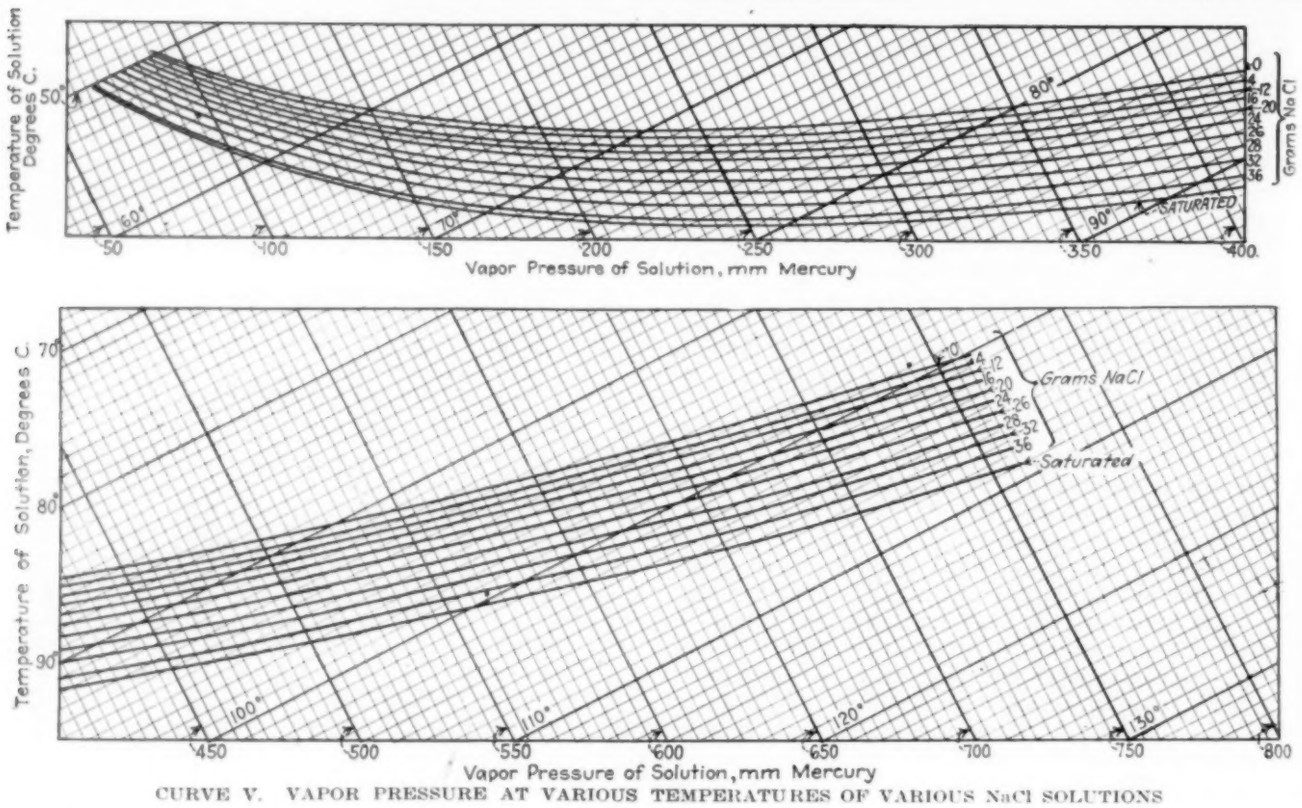
TABLE V. VAPOR PRESSURE OF SODIUM CHLORIDE SOLUTIONS AT VARIOUS TEMPERATURES

Values from Curve V

Vapor Pressure of Solution at Temp. *T*	Temperature of Solutions Containing *G* Grams NaCl per 100 Grams H_2O										
	G=0	*G*=4	*G*=8	*G*=12	*G*=16	*G*=20	*G*=24	*G*=28	*G*=32	*G*=36	Saturated Solution
760	100.0	100.6	101.2	102.0	102.8	103.7	104.6	105.6	106.6	107.6	108.7
740	99.3	99.9	100.5	101.3	102.1	103.0	103.9	104.9	105.8	106.8	108.0
700	97.8	98.4	99.0	99.8	100.6	101.5	102.4	103.4	104.3	105.3	106.5
660	96.1	96.8	97.4	98.2	98.9	99.8	100.7	101.8	102.7	103.7	104.8
620	94.4	95.0	95.7	96.5	97.2	98.0	99.0	99.9	100.8	101.9	103.0
580	92.6	93.3	93.9	94.6	95.4	96.2	97.1	98.0	99.0	100.0	101.1
540	90.7	91.4	92.0	93.7	93.5	94.2	95.2	96.1	97.1	98.1	99.0
500	88.7	89.4	90.0	90.7	91.4	92.1	93.1	94.1	95.0	96.0	96.7
460	86.5	87.3	87.9	88.5	89.2	90.0	90.9	91.9	92.9	93.9	94.7
420	84.2	84.8	85.5	86.2	86.9	87.6	88.5	89.5	90.5	91.6	92.3
380	81.7	82.3	83.0	83.6	84.3	85.1	86.0	86.9	87.9	89.0	89.8
340	78.9	79.6	80.2	80.8	81.5	82.3	83.2	84.1	85.1	86.1	86.9
320	77.5	78.1	78.7	79.3	80.0	80.8	81.7	82.6	83.5	84.6	85.3
300	75.9	76.5	77.1	77.7	78.4	79.2	80.0	80.9	81.9	82.9	83.6
280	74.3	74.9	75.5	76.1	76.7	77.5	78.3	79.2	80.2	81.2	81.8
260	72.5	73.1	73.7	74.2	74.9	75.8	76.6	77.4	78.4	79.4	79.9
240	70.7	71.2	71.8	72.4	73.0	73.8	74.6	75.5	76.4	77.5	77.9
220	68.7	69.2	69.8	70.3	70.9	71.7	72.5	73.5	74.3	75.4	75.9
200	66.5	67.0	67.6	68.1	68.8	69.6	70.4	71.2	72.2	73.1	73.7
180	64.1	64.7	65.3	65.8	66.4	67.2	67.9	68.8	69.8	70.8	71.2
160	61.6	62.1	62.7	63.2	63.8	64.6	65.3	66.1	67.1	68.1	68.6
140	58.6	59.2	59.8	60.3	60.8	61.5	62.2	63.1	64.1	65.2	65.6
120	55.4	55.8	56.3	56.9	57.5	58.1	58.9	59.8	60.7	61.8	62.2
110	53.6	54.0	54.5	55.1	55.7	56.2	57.0	57.9	58.8	60.0	60.3
100	51.7	52.0	52.5	53.0	53.6	54.3	55.0	55.9	56.8	57.9	58.2



CURVE IV. VAPOR PRESSURE OF SODIUM CHLORIDE AT CERTAIN TEMPERATURES



CURVE V. VAPOR PRESSURE AT VARIOUS TEMPERATURES OF VARIOUS NaCl SOLUTIONS

the temperature of the vapor coming from the previous effect and t_2 is the temperature drop really available to cause transference of heat through the heating surface.

A complete table of values was read from Curve V, these data being given as Table V. This table gives the temperature at which the various solutions have a certain vapor pressure, as the data are most serviceable for evaporator design in this form. A "straight line" interpolation may be used between adjacent values to obtain intermediate values without increasing the error of the results. The plotting was carried out carefully, and to large scale, and it is felt that the values given in Table V are reliable to within certainly 0.2 deg. C. and 3 mm. pressure. All of the erratic results given in the regularly accepted standard tables have been eliminated, and the field from 50 deg. C. to the temperature at which the solutions will boil under one atmosphere pressure is given in much greater detail than hitherto. The values for saturated sodium chloride under diminished pressure are not found in any of the regular published tables. The results given are dependable to an accuracy which is more than sufficient for engineering design.

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Diffusion of Solid Copper in Liquid Aluminum

Details of Experiments Where Copper Rods Were Dipped in Molten Aluminum Under Definite Conditions, and the Resulting Alloy Analyzed—Filiation Experiments Also Were Made in Various Ways, All Giving Nearly the Same Results

By ROBERT J. ANDERSON*

IN ORDER to obtain figures with regard to the rate of solution of solid copper in liquid aluminum, the following experimental method was employed: Copper cylinders were suspended in liquid aluminum, for various times and at different temperatures, and withdrawn after the desired elapsed time. The resultant alloy was then poured into a button, and analyzed for copper. Strictly speaking, the results of these experiments cannot give a truly quantitative measurement of anything other than the rate of alloying under definite conditions. However, the principles involved in the commercial manufacture of No. 12 alloy are identical with those in the present laboratory experiments, and consequently measurements such as these are of more direct practical worth to foundrymen than calorimetric diffusivity figures.

A foundryman is mainly interested in knowing how long it requires for the copper to go into solution under the conditions of plant practice, and the experiments carried out in this investigation give positive indications of the time required. As above stated, however, the results arrived at are complicated by factors other than time and temperature, because solution, diffusion and convection are all active,[1] and the results give values for the combined effects of these factors. It is possible, however, to obtain useful information from such experiments, and the chemical analysis of the alloy buttons, as well as examinations of the copper cylinders, afford data as to the rate of alloying.

In foundry-melting practice there is always more or less stirring of the melts when heats are made, whereas in the present experiments there was practically no agitation. While it might have been possible to have employed a definite rate of agitation in the case of these experiments, say by rotating the crucible at a constant rate, the net practical result of such a procedure would be simply to increase the rate of alloying.

Method of Experiment and Materials

In the experiments with solid copper in liquid aluminum, two sizes of copper cylinders, ½ in. in diameter and 4 in. long, and ⅜ in. in diameter and 4 in. long, were used. (12.7 mm. and 7.9 mm. x 101.6 mm.) These were prepared by melting some copper punchings in a graphite crucible and pouring the liquid copper into cylindrical graphite molds. In experiments 1 to 14 inclusive, the larger cylinders were used, and in experiments 15 to 23 inclusive, the smaller ones were employed. In each experiment, 100 g. of aluminum was melted and brought to the desired temperature in a resistance furnace of the crucible type. When the aluminum was liquid and at the desired temperature, a cylinder was suspended in the liquid aluminum by means of a graphite holder and a bronze clamp. In each experiment, the end of the cylinder was ¼ in. (6 mm.) from the bottom of the crucible, and the same surface area of copper was exposed to the same volume of aluminum. The aluminum was melted in a fireclay crucible of such a size that 100 g. of liquid aluminum filled the crucible about three-quarters full. After a cylinder had been suspended in the liquid aluminum for the desired time, it was withdrawn, and the resultant alloy in the crucible was poured into a button. In each test the alloy was thoroughly stirred before pouring, and the button was analyzed for copper. Temperatures were taken with a base-metal thermocouple. In all the experiments the temperatures given indicate the original temperature of the aluminum at the time of suspending the cold copper cylinder; on introducing the cylinder, a drop of 25 to 40 deg. C. occurred. This chilling was corrected by increasing the power input to the furnace, and thereafter the temperature of the liquid aluminum was maintained within ± 10 deg. C. of the desired.

TABLE I. DIFFUSION EXPERIMENTS WITH ½-IN. COPPER CYLINDERS IN LIQUID ALUMINUM

Experiment	Time, Min.	Temperature, Deg. C.	Per Cent Copper in Button
1	1.0	700	0.17
2	2.5	700	0.18
3	5.0	700	0.26
4	7.5	700	0.77
5	10.0	700	2.26
6	45.0	700	20.50
7	1.0	800	0.20
8	2.5	800	1.35
9	15.0	800	2.80
10	45.0	800	38.82
11	1.0	900	1.92
12	5.0	900	4.27
13	7.5	900	11.14
14	20.0	900	41.01

Where the cylinders were suspended for only one minute or two and one-half minutes, the drop was not recovered in these short periods of time. A summation of the results obtained with the ½-in. diameter cylinders is given in Table I.

Additional similar experiments were carried out, using ⅜-in. diameter cylinders. These cylinders were not suspended in the aluminum, however, but were simply so placed in the liquid metal that practically the same surface area of copper was exposed on each. The cylinders were withdrawn after the desired time; the resultant alloy was thoroughly stirred and poured into a button, and the button was analyzed for copper. In order to ascertain whether the surface condition of the copper influences the rate of solution, some of the small cylinders were freshly cleaned before immersion in the aluminum by boiling in 10.0 per cent sodium hydroxide, followed by washing in water. Those cylinders not cleaned had a slight oxide film on the surface. The results of experiments showed that the condition of the copper surface does not influence the rate of alloy-

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[1] As pointed out in an article entitled "Some Theoretical Principles of Alloying." CHEM. & MET. ENG., vol. 23, No. 8, p. 317 (Aug. 25, 1920).

ing to any practical extent provided the surface is not badly oxidized. Hence, in foundry practice, it is not necessary to clean sheet copper or punchings in the manufacture of No. 12 alloy, provided the copper surface is in reasonably fair condition. Table II gives a summary of the experiments carried out with the small cylinders.

Additional experiments were made with thin copper punchings of circular form, punched from medium gage sheet. Such punchings go into solution in aluminum rapidly even at low temperatures; one 30-g. punching was completely dissolved in five minutes at 700 deg. C. in 175 g. of aluminum with no agitation. The composition of the materials employed in the above experiments was as follows:

TABLE II. DIFFUSION EXPERIMENTS WITH $\frac{1}{4}$-IN. COPPER CYLINDERS IN LIQUID ALUMINUM

Experiment	Time, Min.	Temperature, Deg. C.	Per Cent Copper	Condition of Copper Surface
15	2 0	700	0 60	Oxide film
16	5 0	700	6 63	Freshly cleaned
17	10 0	700	21 94	Freshly cleaned
18	1 0	800	0 16	Freshly cleaned
19	2 0	800	1 78	Oxide film
20	5 0	800	6 58	Freshly cleaned
21	1 0	900	4 26	Oxide film
22	2 5	900	7 75	Freshly cleaned
23	5 0	900	9 45	Freshly cleaned

Material	Elements, per Cent			
	Cu	Fe	Si	Al*
Aluminum	0 23	0 34	0 31	99 12
Copper punchings	99 89	....	....	....
Large copper cylinders	99 94	....	....	....
Small copper cylinders	99 86	....	....	....

* Aluminum, by difference.

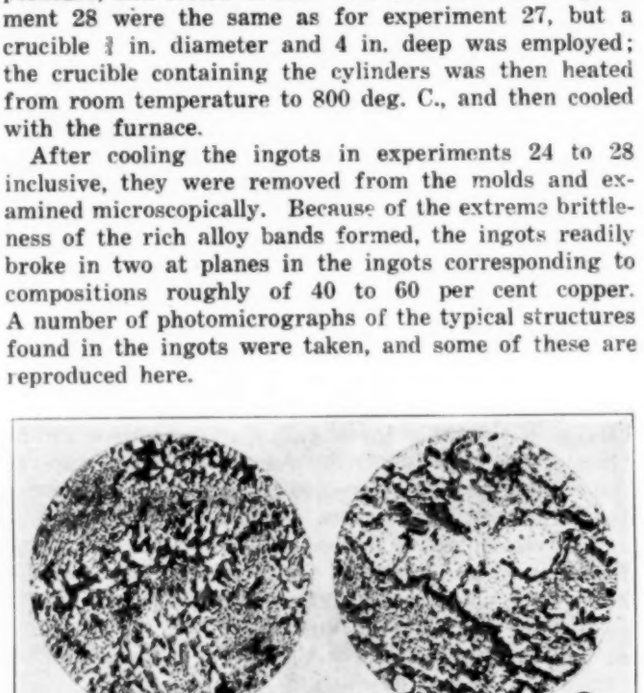
Discussion of the Experiments

The results of the diffusion experiments, summarized in Tables I and II, show that copper readily alloys with aluminum when solid copper is placed in contact with liquid aluminum. The data given in these tables indicate tendencies rather than precise results, and show that copper goes into solution (alloys) with aluminum more rapidly with increasing temperatures, and that small pieces of copper dissolve more rapidly than large ones; in other words, the rate of diffusion is a function of the temperature, of the size and shape of the immersed copper, and of the ratio of the surface area of the solid copper exposed to the liquid aluminum. In preparing alloys of aluminum with copper on a commercial scale, for example No. 12 alloy, by this method, it is advisable to use light-gage punchings and clippings or light sheet scrap.

Filiation Experiments

A few superposition ingots were made in order to show the filiation phenomenon for the aluminum-copper system and also to study this phenomenon in its relation to the subject in hand. These superposition ingots were made in a number of ways, but the results were more or less similar. In experiment 24, the copper was liquefied in a graphite crucible; interior dimensions $\frac{3}{4}$-in. diameter and 4 in. deep. The crucible was about one-half full of copper. Small pieces of aluminum were then added as fast as they melted until the crucible was full of metal; the aluminum was dropped in, and some agitation resulted. When full of metal, the crucible was removed from the furnace and cooled in air. This experiment was repeated as experiment 25, but a crucible $\frac{1}{2}$ in. diameter and 4 in. deep was employed. In experiment 26, copper was melted in a $\frac{3}{4}$-in. graphite crucible in one furnace; aluminum was melted in a clay crucible in another furnace; when both metals were thoroughly liquid, the aluminum was poured onto the copper and the whole melt allowed to cool in air. In experiment 27, a cylinder of solid copper was placed in a graphite crucible 0.5 in. diameter and 4.0 in. deep; the cylinder was one which had previously been cast in a crucible of this size, and it fitted the crucible snugly. The cylinder was 2.0 in. long, and its upper surface was planed smooth and flat. A cylinder of aluminum of the same dimensions as the copper cylinder, and with the lower surface smooth, was placed on top of the copper cylinder so that the surfaces were in close contact. The crucible was then placed in a cold furnace, heated to 750 deg. C., held for two hours at that temperature, and cooled in air. The conditions for experiment 28 were the same as for experiment 27, but a crucible $\frac{3}{4}$ in. diameter and 4 in. deep was employed; the crucible containing the cylinders was then heated from room temperature to 800 deg. C., and then cooled with the furnace.

After cooling the ingots in experiments 24 to 28 inclusive, they were removed from the molds and examined microscopically. Because of the extreme brittleness of the rich alloy bands formed, the ingots readily broke in two at planes in the ingots corresponding to compositions roughly of 40 to 60 per cent copper. A number of photomicrographs of the typical structures found in the ingots were taken, and some of these are reproduced here.



FIGS. 1 TO 6.
Structure of alloy at distances of 1, 2, 3, 4, 5 and 6 cm., respectively, from the top of copper bar. Etched with NaOH. × 150.

When solid copper is placed in contact with liquid aluminum at a temperature below the melting point of copper, alloying of the two metals takes place. The rate of alloying is dependent upon the temperature. When the metals are placed in contact in the order of their specific gravities (aluminum on top) the copper molecules appear to migrate upward. In experiment 26, where liquid aluminum was poured onto liquid copper, a section 6 cm. from the copper contained about 9 per cent aluminum, the copper content of the aluminum alloy on top being richest nearest the copper and leanest at the top of the ingot. This was shown by microscopic examination of the resultant ingot.

The result of superimposing liquid aluminum on solid copper may be shown by a description of the microscopic results of one of the above experiments. The ingot (made in experiment 26) was polished along one side and points 1, 2, 3, 4, 5 and 6 cm. from the copper in the direction of the upper end of the ingot were photographed. The amount of copper contained in the superposition alloy becomes progressively less as the distance from the copper increases. No aluminum could be detected in the lower extremity (copper end) of the ingot. Micrographs in Figs. 1 to 6 inclusive represent areas located at distances respectively 1, 2, 3, 4, 5 and 6 cm. from the copper in the direction of the upper end of the ingot. The structure shown in Fig. 1 is of practically eutectic composition (about 33 per cent copper), and the copper content of successive areas becomes leaner and leaner until in Fig. 6 it is about 10 per cent copper.

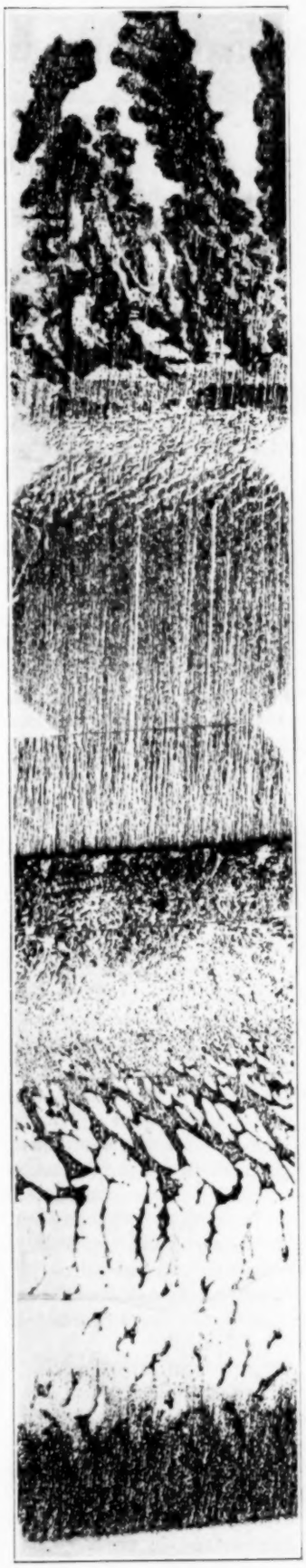


FIG. 7.

Assembled micrographs showing changes from bright copper, below, to a point 6 cm. above. Etched with $NH_4OH + H_2O_2$. × 85.

The microstructure of the area extending from the copper in the direction of the point shown by Fig. 1 is illustrated by a series of micrographs taken at successive points along the section from the copper toward the 1-cm. point. Such a series of micrographs, joined together, are shown in Fig. 7. Considerable difficulty is experienced in securing good photomicrographs of a series of structures in one sample where the composition varies within wide limits, because of the unsuitability of any one etching reagent to a variety of structures. However, the series of micrographs given indicate the changing constitution of successive layers of a superposition ingot fairly well, showing the progressive leanness of successive layers in copper. While interesting, the study of alloys by preparing superposition ingots is not conducive to practical results, and fortunately there are better and more reliable methods.

Summary

It has been shown by laboratory experiments that solid copper goes into solution in liquid aluminum fairly rapidly at relatively low temperatures, and that the rate of solubility and diffusion increases rapidly with rising temperatures. Thus, small pieces of copper go into solution in aluminum fairly rapidly at 700 deg. C., but very rapidly at 900 deg. C. Hence, the commercial method for the manufacture of No. 12 alloy by adding copper directly to aluminum is a rational procedure from the metallurgical standpoint. That it may not be the best method or the one most easily adapted to foundry practice will be discussed later.

Market for American Dyes in Foochow

Evidence of a potential market for American dyes in Foochow is given in a recent report from Consul Ernest B. Price. German dyes, which practically held a monopoly of the market before the war, have been displaced largely by imitation dyes, the labels and packages not showing country of origin. In 1918 the total imports of aniline dyes into Foochow were $10,626; in 1919, $16,064; and in the first quarter of 1920, $11,296. Imports of artificial indigo for 1919 were $20,854, and of vermillion, $15,718. Vermillion imports for the first quarter of 1920 are given as about $4,000. Quite a percentage of the dyes imported is used in the dyeing of paper, scarlet being the color most in demand. Aniline dyes in rose azure, magenta, fast red, indigo blue, orange, green, violet and black are used for dyeing cotton cloth and silk cords.

Lubricating Oil From Asphalt Deposits in Palestine and Syria

A recent report from Consul General Ravndal at Constantinople is to the effect that in order to meet the pressing demand for lubricating oil the directors of the Syrian and Hedjaz railways in 1916 adopted the suggestion of a German geologist to distill the bituminous limestones (asphalt) which are found abundantly in Syria and Palestine. This was done by setting up a special oven and distilling apparatus at a cost of 3.45 piasters per kilo of oil. Between Aleppo and the Red Sea thirty distinct deposits of bituminous schists are known, chief of which are those of Hasbaya, Hadete, Dumar, Mekarine and Nebi Moussa.

Present Status of the Nebraska Potash Industry

Observations on General Conditions and Probable Future of the Industry—Historical Note on the Discovery of Potash in the Nebraska Lakes—Need of Improved Technology in Methods of Operation—Current Fuel and Labor Costs

EDITORIAL CORRESPONDENCE

IT IS conservatively estimated that more than $12,000,000 has been expended in establishing the Nebraska potash industry in the western part of that state, where alkaline lake waters are evaporated for the recovery of mixed salts containing potash in the form of sulphate and carbonate. In spite of the fact that the industry was started during the war and enjoyed high prices for some of its products, the return on the investment has not been adequate. The Nebraska lakes have been our best potash resource for several years past, but for one reason or another the companies as a whole have not prospered.

Considering the attraction which the business held during the early years of the war, when potash could be quickly recovered and sold at high prices, it is not surprising that one or two "wildcats" were promoted and foisted on a gullible public. For the most part, however, the companies which were formed had a legitimate reason for existence and have conducted their operations honestly.

The industry has had its ups and downs, due to various causes, the period of greatest prosperity being due to the shortage of potash caused by the war and the period of greatest depression being due to the change in conditions following the armistice. It seems likely that during the war the Nebraska potash producers became overconfident and felt that their product was so essential that the fertilizer companies or other consumers must take it at any price. It is equally evident that when the armistice was declared the fertilizer companies which had been buying the Nebraska product believed that it would be but a short time before they might again secure foreign potash, and consequently assumed an indifferent attitude toward domestic producers. In fact the fertilizer companies refused to buy and the lack of harmonious co-operation resulted in closing the potash plants in February, 1919, for lack of a market. At that time the producers had on hand about 70,000 tons of salt, containing the equivalent of 25 per cent K_2O. This they were obliged to carry in storage at a considerable expense, refusing to sell at $1.50 per unit material which had cost them from $1.80 to $3 per unit to produce. This conflict of interest between producer and consumer resulted in a cessation of operations until the fall of 1919. In the meantime the accumulation of 70,000 tons was sold gradually at prices varying from $1.75 to $2.25 per unit K_2O.

CONTRACTS FOR 1920 PRODUCTION

Importation from foreign sources during 1919 failed to meet the expectations or needs of the fertilizer companies and a market was again afforded for the domestic product. This resulted in placing the Nebraska potash plants in operation about September, 1919. In the meantime the producers had endeavored without success to obtain tariff protection from Congress, and resumed operations in the hope of making a favorable contract with fertilizer companies. This was the subject of negotiations last spring and resulted in an agreement for the disposal of 50,000 tons of mixed salt averaging about 25 per cent K_2O, at $2 per unit. This is practically the production of the district for the summer season and will insure operation at least until fall. If it then appears that foreign potash will still not be sufficient for domestic consumption, a further contract may be made for the winter output. The fertilizer mixing season extends from September to April, and with the close of each season the fertilizer companies have shown a disposition to wait for foreign potash at a low price rather than contract for the domestic product. This policy works very much to the disadvantage of the producers, however, inasmuch as their best season for production is the summer time, and they should begin operations with assurance that they can sell their products, just about the time the fertilizer companies are finishing their mixing and selling campaign. Thus the producer finds himself in a state of uncertainty as to his market just at the time when he should be most actively engaged in production.

PRICES OF POTASH

The price at which the current season's output is contracted for—viz., $2 per unit—is regarded as being about the minimum which ordinarily the companies can accept and make a profit. In fact it is claimed that the price entails a loss in every plant in the district this year. The general sentiment in the district is that the companies should receive about $2.50 per unit in order to return their investment and realize a profit. Some companies even figure as high as $3, while a few are confident that improvement in the technology will permit well designed and operated plants to run possibly at $2 per unit, or less. Certainly a lower cost can be obtained during the summer season when solar evaporation is a great factor in production.

IMPORTANCE OF NEBRASKA POTASH

According to "Mineral Industry," the domestic production of potash in 1918 was almost double that in 1917, and Nebraska brines supplied 55 per cent of the total. At present the district is capable of producing in the summer season from 500 to 600 tons of mixed salt per day, averaging 24 per cent K_2O. During the winter the output is reduced to 300 tons of mixed salt per day. Eight companies are now actively engaged in production, their plants having capacities varying from 150 tons of mixed salt per day down to 25 tons per day. The following companies have survived the difficult months following the armistice and are the

active producers: The Potash Reduction Co., Hoffland; American Potash Co., Western Potash Co., Union Potash Co., Alliance Potash Co., and Nebraska Potash Works, Antioch; Hord Potash Co. and Standard Potash Co., Lakeside.

Historical Note

In view of the important position which the Nebraska potash industry evidently has attained, more than ordinary interest attaches to its early history. The notes here recorded are from personal interviews with Wilson H. Low, late head chemist for the Cudahy Packing Co., Omaha, Neb., and Carl L. Modesitt, of the Potash Reduction Co.

About 1906 a Mr. McCarthy of Alliance, Neb., offered to sell to the Cudahy Packing Co. about thirty tons of alkali which he had scraped from the dried surface of one of the lake beds in the western part of the state. The Cudahy company purchased the lot and used it without further purification for making caustic soda solution. In fact soda was the only salt of interest to either Mr. McCarthy or the Cudahy company, and no one had suggested that potash might be present. The incident resulted in a trip by Mr. Low to examine some of the lakes, and subsequent trips were made in two successive seasons. Conditions were found as represented by Mr. McCarthy and resulted in a careful survey of Jesse Lake, its area, probable depth of mud and amount of alkali on the surface and in the mud. In September, 1908, Mr. Low reported to E. A. Cudahy that on the occasion of his last visit Jesse Lake was largely dry and covered by a thick deposit of crystallized alkaline salt over an area of several hundred acres. A 50-lb. sample of mud was taken from the lake bed and a sample of the salt deposit was scraped from the surface of 25 sq.ft. A laboratory examination of these materials showed that the mud contained about 3 lb. of dry sodium carbonate or its equivalent per cu.ft. The crystal deposit on the surface contained sodium carbonate or its equivalent to the extent of about 10 lb. per 25 sq.ft. Calculated in quantities per acre, these figures showed sixty-five tons of sodium carbonate or its equivalent in the mud and nine tons on the surface, or a total of seventy-four tons per acre in the top foot. As a result of the analyses made by him on this occasion, Mr. Low discovered that the alkali contained appreciable quantities of potash, which made the deposits more valuable than if they contained soda only. Soda ash was then worth about $18 per ton in Omaha, while potassium sulphate or chloride was worth over $100 per ton for mixed fertilizer or other purposes. Accordingly he recommended that Cudahy Packing Co. acquire control of some of these lakes as a source of potash for fertilizer and other purposes, but, owing to other projects which this company had under way at that time, no steps were taken to get hold of the lakes.

The record of Mr. Low's investigation and analyses was available to anyone who was interested, and when the Cudahy company showed no active interest the matter was taken up by John H. Show, head assistant in Mr. Low's laboratory. Mr. Show interested some associates, Carl L. Modesitt, C. C. Denny and V. I. Jeep, who decided to treat the lake waters for the recovery of alkali.

In March, 1910, Mr. Modesitt conducted a rough survey of about twenty ponds and lakes, and analysis was made of about seventy samples of water, mud and crystal. In February, 1912, Mr. Modesitt erected an evaporating tower and made about one ton of crystallized salt which he submitted to different fertilizer companies. A further survey of the alkali lake region was made during 1912-13, and in 1913-14 the refining problems were studied with a view to separating the potash and soda for the purpose of reducing freight cost and securing a higher price for the refined products. By April, 1915, Mr. Show and his associates, who had organized the Potash Products Co., had spent about $17,000. They then got sufficient financial backing to start a plant on a commercial scale, and they assembled and erected a 125-hp. boiler and two evaporating pans with steam coils. Water was pumped from Jesse Lake through a 2½-mile pipe line to the plant. Operations began June 10, 1915, and the first carload of mixed salt was shipped eight days later. The Potash Reduction Co. succeeded the Potash Products Co. in August, 1917, and has continued to be one of the prominent factors in Nebraska potash production.

War Insured Success of Venture

The financial success of this first venture was greatly enhanced by war conditions, which placed a high premium on potash, and the Potash Products Co. sold its early production for as much as $5 per unit K_2O. It was inevitable that others should be attracted to the industry, and as a consequence the Nebraska Potash Co., the American Potash Co., the Hord Potash Co., the National Potash Co., the Western Potash Co., the Alliance Potash Co., the Standard Potash Co. and others came into existence in 1916-17. In addition to these larger concerns, which built the most important plants, there were between twenty-five and thirty companies of minor importance, about half of which produced some potash.

It is evident from this brief sketch that the credit for the original discovery of potash on which the industry subsequently was founded belongs to Mr. Low, while to Mr. Show and his associates is due the credit for the first commercial development.

Methods of Operation

General conditions in the district and a description of the methods of operation have already been published in Chemical & Metallurgical Engineering[1] and there have been few changes of importance since that article was published, due largely to the fact that the plants were closed for so long a time. Operations consist in pumping water from the surrounding lakes, often as far as twenty miles; evaporating in multiple-effect evaporators to about 33 per cent solids, and finally drying in rotary kilns which discharge the dry-mixed soda and potash salts. It is considered unprofitable to pump and evaporate water of less than 4 per cent total solids, of which perhaps half is potash salts. During the summer season solar evaporation is a great aid to production and it is customary to "farm" the lakes by pumping from one to another. If water from one lake is pumped onto the dry bed of another, and taken out again at the opposite side, solar evaporation will have concentrated the water to several times its original salt content. Mr. Low has made some calculations of the value of solar evaporation, based on the fact

[1] "The Nebraska Potash Industry," by Ernest E. Thum, vol. 17, No. 12, Dec. 15, 1917.

that in hot weather in western Nebraska evaporation will amount to from ¼ in. to ½ in. per day. At the lower figure the evaporation from an acre of water would amount to twenty-five tons per day, so that from a 100-acre lake it would be possible to evaporate 2,500 tons of water per day, due to solar effect alone. By suitably handling the lower-grade lake water it is possible to deliver to the plant a brine of high specific gravity practically ready for final evaporation.

Wooden pipe lines have been largely substituted for iron for the transportation of water from lakes to plant. Some companies have as high as 100 miles of pipe, which involves a large expenditure. It is necessary to lay the pipe below the surface, and 8-in. pipe costs about $5,000 per mile laid and 6-in. pipe about $3,500 per mile.

Evaporator Practice

Evaporator practice has been much improved since the early days of the district and the equipment of the later plants is superior to that of those first built. The kilns are oil fired, but experiments have been made with powdered coal which indicate that economies can be effected by the latter fuel. According to the best practice in the district it now requires about 55 gal. of oil to produce one ton of dry salt when the kiln feed contains about 33 per cent solids. Preliminary experiments by the Hord Potash Co. with powdered coal indicated that the same work could be done with 1,000 lb. of coal; and since oil costs 8c. per gal. and coal over $4 per ton at the plant, there would be a decided advantage in the use of coal if it could be satisfactorily applied without requiring too much plant equipment. Recent information is to the effect that the Hord company has adopted and installed Aëro size B and D pulverizers and that a saving is being made of $1.50 and $2 per ton of dried salt.

The cost of all operation has increased greatly since the plants were first built and started. In the beginning it was possible to get coal from Sheridan, Wyo., at 35c. per ton f.o.b. mines and a freight charge of $2 per ton. In April, 1920, the same coal was costing $1.70, and in August, 1920, $1.95, f.o.b. mines, with a freight charge of $2.30 per ton. Labor originally cost the companies from 15c. to 20c. per hour with meals and lodging, the latter amounting to about $1 per day. In April, 1920, the charges were from 50c. to $1 per hour with an average of 62½c., the men paying for their bed and board. Freight on potash from the district to southern points was $10.80 per ton last spring, but of course this will be notably advanced if it has not already been advanced.

Improved Technology Necessary

There is a tendency throughout the district to get more and better technical advice than was customary in the early history of the region. This may be regarded as one of the most hopeful signs for the future of the industry, inasmuch as it is quite evident that improved technology must be relied upon to reduce the cost of production and enable the companies to meet foreign competition when it becomes active.

In addition to obvious economies in boiler and evaporator practice, probably one of the best lines of improvement will be in the separation of sodium from potassium salt. At the present time the product of the district contains about as much soda as potash. The former is without value to the fertilizer companies and serves merely to dilute the potash and increase the expense for freight. By making a separation of the salts it would be possible to produce several materials of value instead of one. A number of processes are now under experiment and it would seem as though the present season should witness the development of methods that can be put into active use next year. One of the processes involves causticizing the concentrated brine with CaO, the subsequent conversion of caustic potash to sulphate by the addition of sodium sulphate, with final evaporation and salting out of the potassium sulphate, the caustic soda remaining. Other processes under experimentation involve fractional crystallization of the different salts and production of soda ash.

A radical departure from general practice in the district was made last spring by the Merriman Potash Products Co. in an effort to make a product approximating a mixed fertilizer. It was claimed that by treating phosphate rock with brine in the drying kilns, a conversion takes place which renders the phosphoric acid soluble and therefore available. The reaction is not clear, although it is known that the so-called calcined phosphate produced by mixing phosphate rock, sodium sulphate and carbon, and subjecting the mixture to the heat, will render phosphoric acid available. It is doubtful if enough work has been done to determine the value of this procedure, but if it meets the claims of the company it is possible to secure plenty of phosphate rock from Idaho and Montana, treat it in transit and forward the product to the fertilizer companies. The company has since gone into the hands of a receiver and none of the other plants in the district is attempting to make this kind of product. It is doubtful, therefore, if there will be any further developments in the near future.

Future of the Industry

The future of the Nebraska potash industry cannot be determined with any degree of finality at this time, although there is ample reason to believe that the industry can exist profitably for a long time. There will be the inevitable dropping out of the smaller and weaker concerns, and the strengthening of the larger companies by better technology and business methods. A greater study of the lake areas and of methods of concentrating the brine will undoubtedly reveal tremendous resources. Solar evaporation and systematic "farming" of the lake waters will also play a large part, and in fact the industry may develop into a seasonal one. Sooner or later the industry must meet foreign competition, because potash from abroad is being imported in increasingly large quantities, and will continue to come in the future. There is reason to believe, however, that the domestic industry will be able to meet this competition and continue to operate at a profit. In this connection it is quite evident that harmonious relations between the producers and the large consumers will do much toward stabilizing the industry.

Profits of Swedish Government Water-Power Administration

The Swedish Government operation of water-power sites reports a gross income for 1919 amounting to 13,897,649 crowns and expenditures of 7,622,750 crowns. Nearly all the water-power plants now in operation show a profit to the government, and most of the expenditures are for additions and new construction work on power sites that have not yet been completed.

Properties and Industrial Uses of Cellulose Acetate*

A Summarized Outline of the Properties of the Normal Acetate and of Its Uses in the Manufacture Especially of Dope, Celluloid, Impermeable Fabrics, Artificial Leather, Artificial Silk and Electric Insulation

BY MAURICE DESCHIENS

THE normal cellulose acetate or tri-acetate, more or less mixed with di-acetate, appears in the form of a coarse powder or as rough amorphous filaments whose structure varies with the cellulose used, the method of preparation, the ripening and the conditions of precipitation. Thus cellulose acetates prepared from wood cellulose are in general coarser, rougher and more viscous in acetone solution than those obtained from cotton.

The average density of cellulose tri-acetate is 1.2. When distilled or volatilized it is decomposed at about 210 deg. C. The higher acetates, unless perfectly washed and stabilized, have a tendency to decompose into simpler esters with the formation of free acetic acid, a decrease in solubility and increase in viscosity. The tri-acetate is less flammable and less combustible than the nitrocellulose.

SOLUBILITY

The commercial cellulose tri-acetate is completely insoluble in water, pure methanol, ethyl alcohol, butyl alcohol, ether, benzene, methylacetone, pure ethyl acetate, amyl acetate, tetrachlorethane, butyl formate, carbon tetrachloride, toluene and triphenyl phosphate. It has the property of swelling in contact with water, alcohols, benzene, butyl formate and methylethylketone. This property of swelling is the more marked when in contact with water at ordinary temperature and with a mixture of equal parts of methanol and ethyl alcohol and benzene at about the boiling temperature. When thus swollen the acetate is much more sensitive to the action of certain solvents such as acetic acid, is completely saponified at ordinary temperature in a few hours by N/2 potash, and absorbs with great rapidity and in proportion with its degree of swelling dyes such as methylene blue. This last property is used industrially.

The cellulose tri-acetate is soluble in the cold in a great number of organic solvents such as acetaldehyde, acetal, acetone, formic acid, acetic acid, methyl formate, ethyl formate, methyl acetate, aniline, phenols, cresols, benzyl and oxybenzyl alcohols, pyridine, quinoline, triacetine, cyclohexanone, amyl and butyl tartrates and citrates, benzyl aldehyde, acetylacetic ester, ethyl oxalate, ethyl lactate, acid oxalates and lactates, mesityl oxide, glycol di-acetine, carvacrol, carvol, eugenol, isoeugenol, safrol, isosafroi, phthalic esters, guaiacol, creosote, acetamide, anethol and terpinol. It is more soluble in warm eugenol, furfurol, triacetine and chloroform. Its solubility at boiling temperature in a mixture of equal parts of methanol or ethyl alcohol and benzene is used in the manufacture of cellulose acetate in sheets and in plastic masses.

A fact which deserves special attention is that substances which may be called auxiliary solvents, when alone, do not dissolve cellulose acetate, but when these substances are mixed with non-solvents of acetates, such as ethyl alcohol, methanol and benzene, which may be called diluents, the mixture becomes a cellulose acetate solvent even with small quantities of the diluent. This is the case with methylethylketone, ethyl acetate, tetrachlorethane, cold chloroform and butyl formate. For example, when ethyl acetate, a non-solvent of cellulose acetate, is mixed with 4 to 5 per cent of ethyl alcohol the mixture dissolves the cellulose acetate in the proportion of 1 g. acetate per 9 g. of the mixture.

INDUSTRIAL USES

Aëronautics Industry.—Prior to the development of aëronautics, cellulose acetate dope has been used to coat balloon fabrics, making them impermeable to gases. A typical composition was:

	Grams
Cellulose acetate	15
Rubber	2
Tetrachlorethane	100

The considerable progress realized during the last few years in heavier-than-air aëronautics, with the resulting need to impart to the planes certain qualities, contributed greatly to the development of the industry of dopes having cellulose acetate as base.

These dopes are obtained by dissolving cellulose triacetate in a mixture of more or less volatile solvents. This mixture consists of light solvents (acetone, methylacetate, ethyl formate) having a boiling point as low as 50 to 60 deg. C., to which is added diluents such as ethyl alcohol or methanol, benzene, with a boiling point of 80 to 115 deg. C., and heavy gloss-retaining solvents such as benzyl alcohol and phenol, which vaporize very slowly and only partly, their boiling point being 130 to 200 deg. C.

By evaporating the solvents there is left an elastic film of variable thickness which has to have the following qualities: Homogeneity, transparency, retractibility at the time of its formation, elasticity, suppleness, tenacity, impermeability to water, castor oil and volatile oil, and ability to increase the tension and tearing resistance of the coated fabrics and make the surface of the coated fabrics polished in contact with the air so as to reduce the coefficient of friction of the air on the planes, and thus insure a greater velocity of the airplanes.

STANDARD DOPE FORMULAS

During the war extensive tests were carried out by the Allies on a formula for a dope which resulted in the adoption of the following standards which have given excellent results:

Cellulose acetate	80	80
Diluents and light solvents	860	890–880
Heavy solvents (benzyl alcohol or phenol)	30	40
	(summer)	(winter)

*Abstracted and translated from *Chimie et Industrie*, May, 1920, pp. 591-607; see CHEM. & MET. ENG., vol. 23, No. 11, p. 533.

or:

Cellulose acetate	80
Diluents and light solvents	800
Furfurol	60

The relative quantities of diluents and light solvents, the products being pure, are:

Acetone (light solvent)		410
Benzene, Alcohol	diluents	250 230–220

or:

Methyl acetate (light solvent)		513
Benzene, Alcohol	diluents	250 117–127

or:

Ethyl formate (light solvent)		455
Benzene, Alcohol	diluents	250 125–175

The light solvents may be replaced in the above formulas in the proportion of 3:8 by the following light auxiliary solvents: ethyl acetate, methyethylketone, and butyl formate.

The dope is applied in three layers on the linen fabrics after these are already fixed on the wings of the plane. The total thickness of these layers is such as to represent 70 to 80 g. per sq.m.

Tests of the Coated Linen Fabrics

Tensile Strength.—The tensile strength of the linen is determined by an apparatus called aërotensiometer, represented in Fig. 1, which measures the deflection produced in the stretched non-coated or coated fabrics by the application in the center of a known weight. The apparatus consists of the following essential parts: A metallic disk *B* having a rim *R* which is applied to the fabric to be tested. The plate *P* presses on the fabrics under the action of the spring *S*. The deflection is indicated on *D* to the tenth of a millimeter.

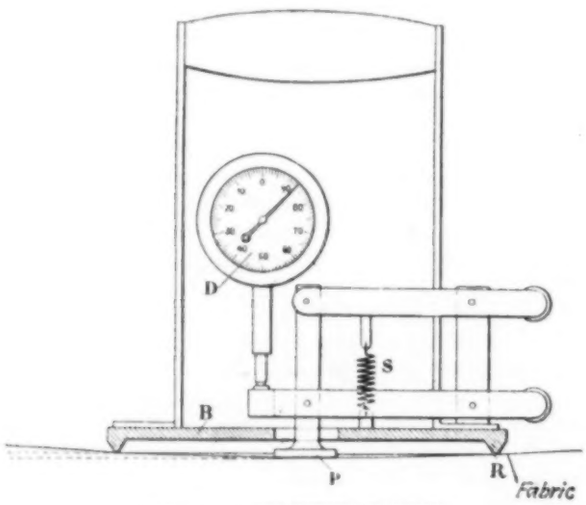


FIG. 1. AEROTENSIOMETER

Tests made with this apparatus gave the following deflection values for non-coated and coated fabrics:

	Deflection Mm.
Stretched non-coated linen fabrics	13.7
Same quality of linen stretched and coated with:	
1. Layer of standard acetone and benzyl alcohol dope, the thickness of the film being 36 g. per sq.m.	6.0
2. Layer of same dope, thickness of film being 56 g. per sq.m.	4.9
3. Layers of same dope, thickness of film being 74 g. per sq.m.	4.3

The minimum deflection is obtained when the thickness of the film corresponds to 80 to 85 g. per sq.m.

Impermeability.—This is measured by noting the number of days required for water to permeate through the film.

Resistance to Rupture.—When tested with the warp or with the woof the non-coated linen fabric presents a resistance to rupture of 1,500 kg. per lineal meter; when coated with three layers of dope, the thickness of the film corresponding to 70 to 80 g. per sq.m., the resistance to rupture is increased from 25 to 50 per cent. The average resistance to rupture is 1,812 kg. per lineal meter with the warp and 2,175 kg. per lineal meter with the woof.

According to A. de Guiche, for an airplane traveling at a speed of 250 km. per hour (150 miles per hour) the pressure exerted on the plane is 180 kg. per sq.m., which corresponds to a tension of only 150 kg. per lineal meter. This figure indicates that coated fabrics present a high safety coefficient.

Industry of Celluloid, Plastics, Films

Cellulose acetate, being less flammable than nitrocellulose, is used now extensively in the preparation of celluloid.

A typical example of the composition of such a celluloid is that of Ernst Zühl (American patent 729,990, 1903): 70 parts nitrocellulose, 30 parts cellulose acetate, 50 parts camphor.

There is now a great variety of formulas used for the manufacture of non-flammable celluloids. They may or may not contain camphor. They also may contain cellulose esters, various solvents, oils, casein, mineral pigments, etc.

The manufacture of acetic cellulosic plastics may be considered as a branch of the celluloid industry. The principle on which is based the production of these plastics is that the cellulose tri-acetate, which is soluble in acetone and totally insoluble in alcohol and benzene or their mixture, can be dissolved by a mixture of equal parts of acetone with alcohol or benzene at about boiling point, from which it is re-precipitated as a gelatinous mass when the temperature is lowered.

The entire process of the manufacture of cellulose acetate plastics consists first in the realization of the above-described solution and precipitation. The liquid is now decanted, camphor or another plasticizing mass is added to the gelatinous precipitate and heated to 50 to 60 deg. C. until a homogeneous mass which can be molded, cut and pressed is obtained. This mass may also be squeezed through dies for making bars, threads, etc. (Société Industrielle de Celluloid-Sicoid, etc.)

These plastics are used for the manufacture of imitation amber, scales, combs, artificial flowers, etc.

Cellulose acetate sheets used for guards, transparent plates for automobiles and airplanes, windows, etc., are manufactured by mixing cellulose acetate pastes with plasticizing products and with other substances as desired. These mixtures are then rolled, compressed in block presses, cut with special cutters, some of which are automatic, and straightened when hot by appropriate presses.

Reinforced acetate sheets are manufactured by the same process, but with the use of special mechanical apparatus for the incorporation of metallic reinforcing.

The plastic plates resist well the action of rain, snow and other atmospheric agents, when they contain a sufficient proportion of plasticizing products and heavy solvents.

The principle of the manufacture of photographic plates and sheets is the same as that for plastic sheets, but special care has to be exercised in the mechanical regulation of the thickness of films, the plasticizing material used and the application of a sensitized gelatine coating.

Impermeable Fabrics—Washable Linen

Impermeable fabrics may be obtained by impregnating the fibers with cellulose acetate solutions. Similarly washable linen is obtained either by treating the linen with a 20 per cent solution of cellulose acetate in an appropriate solvent and applying to the treated linen a nitrocellulose varnish, or by the application of a basic aluminum acetate, drying and coating with cellulose acetate.

Artificial Leather—Patent Leather

Artificial leather is manufactured from the cellulose acetate of old films. Cloth imitating the grain of leather is coated with a mixture of cellulose acetate, appropriate solvents such as chinawood oil, linseed oil, castor oil, pigments, fillers such as chalk, kaolin, cork and other substances such as gutta percha, oils and glycerine.

Patent leather is obtained by coating the leather with any of the above mixtures or with a mixture having a nitrocellulose base. (U. S. patents 627,493—1899; 848,357—1907, etc.)

Artificial Silk

A great number of patents have been granted for the manufacture of artificial textiles having cellulose acetate as base, but practically all of these patents follow the same principle, namely:

Cellulose acetate thread is obtained by passing its solution through orifices into another solution which precipitates the acetate. The thread is used for artificial textiles, filaments for incandescent lamps, gas mantles (Welsbach system), artificial horsehair, artificial silk, etc.

Of these the most important is the manufacture of artificial silk. The production of artificial silk with a cellulose acetate base is progressing rapidly, especially in the United States, Great Britain and Belgium. The consumption, which in 1914 was 11,000,000 kg., is now greatly increased.

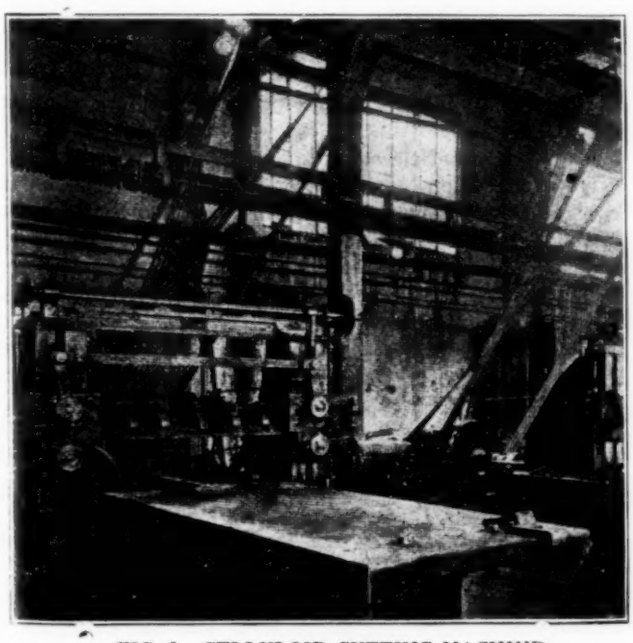


FIG. 2. CELLULOID CUTTING MACHINE

There are two distinct methods of manufacture—namely, the wet process and the dry process. [This is also the case for the manufacture of artificial silk with nitrocellulose base (Chardonnet) or by dissolving cellulose and hydrocellulose in ammoniacal copper oxide solutions (Parisian silks, Pauly-Glauzstoff) or with xantate silk (viscose).]

Wet Process.—The cellulose acetate in the form of a very viscous paste with appropriate solvents and plasticizing agents which makes it supple is forced through capillary orifices of glass, crystal, or even platinum. The thread is led into a bath containing a solution which precipitates the cellulose acetate and eliminates almost all of the solvents. A number of these fine threads are twisted together by means of spools rotating at very high speed; this multiple thread constitutes the artificial silk which can be woven.

The volatile solvents used in this method are recovered, thus lowering the cost price.

Dry Method.—A viscous solution of cellulose acetate is passed in a steady stream through fine orifices into an airtight chamber heated to about the boiling temperature of the solvents used. The semi-solid thread is wound around rapidly rotating drums placed in the interior of the chamber. The solvents are gradually eliminated and the threads solidify. Here also a number of these fine threads are twisted into one thread which constitutes the artificial silk.

The recovery of the solvent is very easy in this case. It is sufficient to recover it from the hot air which is saturated with solvent vapors by any one of the known modern methods.

The artificial silk with a cellulose acetate base is non-flammable, very brilliant, very supple, its specific resistance to moisture is greater than that of any other kind of artificial silk, it washes very well without deterioration and constitutes the best washable silk. It is easily distinguished from the other kinds of artificial silks by its density, which is 1.250, solubility in acetic acid, insolubility in a cupro-ammoniacal solution and by its becoming yellow when treated with iodine and sulphuric acid.

Artificial Sponges

The product obtained by incorporating fibrous materials and sodium chloride or sugar with a cellulose acetate paste and washing with water constitutes artificial sponges. (British patent 21,524—1914.)

Electric Insulators

The use of cellulose acetate as insulator for electric wires and cables becomes more and more generalized, especially in America and Great Britain. The acetate is used in the form of threads which are wound around the cables or in the form of a solution in a volatile solvent which when evaporated leaves an insulating coating of cellulose acetate.

Miscellaneous Uses

Cellulose acetate is also used in the composition of certain explosives, in the manufacture of phonograph records, bayko thread, capsules, lacquered paintings, certain adhesives, and special cements, artificial pearls, and as a gelatinizer associated with gelatine for the manufacture of solidified alcohol.

The Value of Patents

By Chesla C. Sherlock

IT IS very seldom, even in this country, where thousands of patents are granted annually, that we pause to consider just what a patent is worth. Many persons are discouraged, when they come to seek a patent, because they think it is too much of an effort, too hard to obtain to be worth while for a trivial invention or improvement.

A patent is worth all the effort necessary to obtain it. The very fact that it is hard to obtain the grant, that it is given only after the most painstaking search of the records of the Patent Office, should in itself signify that it is something more than a "mere scrap of paper."

Just what does a patent grant to the patentee? The rights and privileges which he obtains have been reduced to a few simple statements gleaned from the statutes and the opinions of the courts.

1. Exclusive right to make the invention for seventeen years.
2. Exclusive right to use the invention for seventeen years.
3. Exclusive right to sell the invention for seventeen years.

This exclusive right to the manufacture, use and sale of the patented article is termed three rights of monopoly, and they apply to the entire territorial jurisdiction of the United States. They survive to the heirs and assigns of the patentee.

As expressive of these rights of monopoly in the patented article, the courts have held that the following additional rights repose in the patentee:

1. To exclude all others from making, using or selling same.
2. Right to an injunction against further infringement and to recover all profit lost by wrongful infringement of patentee's rights.
3. Right to restrict making, using or selling in any manner desired.

In order to comprehend the vast rights which a patent confers upon an inventor, one has only to recall the fact that all monopoly is ordinarily odious to the law and that the law seeks at every turn possible to destroy it.

Patentee's Monopoly Protected by Law

But in the case of a patent, we find the law not only sanctioning a monopoly but in fact creating that monopoly and conferring it upon one citizen or other person to the exclusion of all others. But that is not all. The fact is that the law not only creates the monopoly, but is bound to protect the patentee in that monopoly during the life of the patent. Such, then, is only one of the rare privileges which accrue to a patentee under our patent laws.

Any effort to restrict or control sale prices of a manufactured product under our laws has met with instant prosecution on the part of the Government. The Government has ever declared itself to be in direct conflict with all who seek in any way to limit the price at which their products may sell.

Is this true in the case of patented articles? Strange to say, most strange indeed it will appear to business men, the courts have not only kept their hands off, but the prosecuting branch of the Government has also remained passive, for it was long ago determined that patent owners have the right to restrict selling prices. The Gillette Safety Razor case or the Victor Talking Machine agreements are instances in point with which most of us are familiar. The patentee in these cases has not only fixed the resale price of his product, but he has further specified the uses to which his product may be placed, and if the purchaser fails to use the products as specified, he becomes an infringer under the patent laws and may be sued for damages by the patentee. In the case of the Gillette razor the mere resharpening of the blades is an infringement, or in the case of the Victrola, to play records of another make upon the Victrola amounts to infringement.

Limitations to Patent Monopoly

It is, however, coming to be recognized that some limitation or curb must be placed upon the right to control resale prices, else the whole structure of our anti-trust laws would, in some instances, come tumbling down. In the famous O'Donnell case, it was held that the resale price cannot be controlled by the patentee or owner where the patented article passes through another's hands. In this case it was said that the retailers can, in that event, no longer be held as infringers if they cut prices. But if the manufacturer or owner of the patent uses his own selling organization and eliminates all middlemen, selling direct to the dealers, he can still regulate his prices to retailers, and this is just the method that the Victor people and others use to control the resale price of their product.

One court has said: "Within his domain the patentee is czar. The people must take the invention on the terms he dictates or let it alone for seventeen years. This is a necessity from the nature of the grant. Cries of restraint of trade and of the impairment of the freedom of sales are unavailing, because for the promotion of the useful arts the Constitution and the statutes authorize this very monopoly."

Patents Are Personal Property of Patentees

It should also be kept in mind that a patent is personal property and cannot be taken away except by due process of law, which includes only constitutional decrees of competent courts. It does not include legislative acts either of Congress or of the Legislature. It cannot be seized under a writ or other execution of the common law, but it may be attached by a creditor's bill in equity, in default of the payment of a judgment.

The law provides that all patented articles must be plainly marked so that all may know the facts. But if one marks an article so as to give an impression that it is patented when, as a matter of fact, such is not the case, it is a criminal offense, punishable by a $100 fine, one-half of which goes to the person bringing the action.

Patents are not merely a trivial right which one may obtain at a great deal of effort. They are among the most valuable property rights which an individual can possess. The law has done everything possible, even to overturning well-established rules of public policy, to make the patents as valuable and as effective as possible.

No business right enjoyed can be greater than a monopoly. A patent is not only a monopoly in one particular, but in several. It goes without saying that it is worth while for anyone to obtain a patent on his inventions or improvements, for the law intends that he should have it and the fruits thereof. It is only a partial recompense for the service rendered all the people in the improvements made as a result of the patentee's skill, genius or craftsmanship.

Synopsis of Recent Chemical & Metallurgical Literature

Humic Acids.—In the July 24, 1920, issue of *Chemiker Zeitung*, Dr. FRIEDRICH FUCHS describe the result of his work on the humic acid obtained from peat by the action of alkalis. He found that humic acid is a true acid and not a colloidal substance. It gives simple (not double) salts with bases following the stoichiometric laws. The analysis of the free acid gives C = 57.4 and H = 4.6 per cent, with little N and less than 1 per cent S. Humic acid from non-purified peat contains greater amounts of sulphur. Humic acid treated with organic or inorganic acids always gives a precipitate. Alkaline humates are only partly precipitated by a solution of sodium chloride but are completely precipitated by hydrochloric acid. The latter precipitate when dried gives a brown powder easily soluble in soda, whereas the former dried precipitate is darker and insoluble or only slightly soluble in soda. Humic acid treated with Na_2SO_3 gives a soluble sulphite which reacts with aniline and other organic bases.

Curative Effect of Acids in Breathed Air.—It is reported by Dr. VON KAPFF in *Die Umschau* (vol. 24, pp. 45-8, 1920) that the presence of a small quantity of a gaseous acid in the atmosphere if not breathed to excess is not only not injurious but tends to prevent and even to exert a curative effect on diseases of the air passages. The amount should not exceed 0.1 to 0.2 g. per cu.m. and the breathing was continued in his tests for two or more hours daily. The acids employed were hydrochloric, hydrofluoric, sulphurous (SO_2), formic and acetic, and he found the stronger inorganic acids the better curative agents. He claims that the reaction of the mucous membrane is kept acid by the inhalations and that as a result pathogenic organisms cannot grow there. The curative effect is said to be due to the production of hyperemia and possibly the consequent stimulation of the body cells to increase the alkalinity of the blood. The conclusions are reached from experiments made by the author and also from experience with workmen in various industries.

Relative Action of Acids on Enamels.—The progress report of the Sub-Committee on Enamels as printed in the July, 1920, issue of the *Journal* of the American Ceramic Society represents a very large amount of carefully executed experimental work and discloses material progress in arriving at the desired result, to the profit of manufacturers of enameled ware.

It was found that citric acid offers a fairer means of testing enameled coatings than does tartaric acid. Using two different frits and plotting curves, it was noted that there is a reasonable uniformity of action around 15 per cent acid, small variations of concentration in either direction making but slight effect in the total activity. This figure was therefore decided upon. Temperature variations were then studied with a 15 per cent solution of citric acid. Range of 15 to 35 deg. C. was found to materially affect the results. Commercial citric acid was found to be of sufficient purity to give uniform results. Six ounces of acid in one quart of water gives a 15.73 per cent solution and was used for the tests.

Tests were made over 24-hr. periods under temperatures ranging from 12 to 20 deg. C. The etching by acid was determined by rubbing finely-ground charcoal on the surface of the ware, producing definite discoloration in the etched portions below the liquor line and none above. A 3 g.p.l. solution of malachite green was also used, being allowed to stand five minutes and the dishes being rinsed out. The resultant discoloration of etched portions gave more uniform results with varying strengths of acid than in the case of charcoal. The experimental work is still under way.

The Concentration of Graphite Ores, Past and Present.—The first graphite mill in Canada began operations about fifty years ago, using a buddle as a concentrating device. Ore was broken in crushers and stamps and roughly classified, the products being fed to buddles which produced concentrates, middlings and tailings. Middlings were re-treated in buddles. The concentrate was treated by the buhr stones and screens. The latest mills use flotation as an essential step in the process, the concentrate being treated by buhr stones and screens, or, in some cases, rolls may be substituted for the buhr stones. In the Aug. 20 issue of the *Canadian Mining Journal* is published an article by R. C. ROWE describing the development in the processes, together with a brief discussion of the limitations of the flotation process as applied to graphite ores, from which the following is abstracted.

Canadian graphite occurs principally in more or less flat flakes ranging in size from $\frac{1}{8}$ in. in diameter to microscopic dimensions and disseminated throughout the accompanying rocks. The specific gravity is about 2.2 for the graphite and 2.6 for the gangue. As the chief use of graphite is in the manufacture of crucibles and as only the larger flakes can be used for this purpose, the efficiency of any process of concentration is determined to some extent by the quantity of crucible flake recovered.

As the graphite and gangue are of about the same specific gravity, it is difficult to obtain efficient recovery using gravity methods of concentration only, and all efforts in concentrating previous to the use of flotation may be considered commercial failures, although used extensively previous to the introduction of flotation processes. The use of buddles in a wet process of concentration has been noted. A dry process has been used for some time which consisted of drying the ore in rotary kilns or driers, grinding to produce a minus 20-mesh product which was fed to high-speed flour rolls. The principle of the process was that the flake, being flat and tough, would pass through the rolls uninjured, while the gangue, being friable and granular, would be pulverized and could subsequently be removed from the flake by screening. The roll product was screened over 40-mesh and the fine material re-treated by rolls and finer screens. The most recent mills use rolls and screens for treating high-grade concentrate, but this method when used on 10 to 12 per cent ore was not efficient, due to excessive destruction of the flake graphite, to excessive wear of both rolls and screens and to low recovery. A plant using wet crushing, grinding, classifying and tabling was next built, and although the small difference in specific gravity between the graphite and gangue caused difficulty the plant was the most successful working on disseminated ores previous to the adoption of flotation.

The use of gravity methods for concentration brought out the fact that the graphite is intimately

intercrystallized with the gangue material and requires fine grinding in order to liberate the graphite. This is an important point to be considered in the application of flotation processes to graphite ores and emphasizes the problem of proper grinding in order to obtain satisfactory recovery. It has been found that the flake graphite is freed more easily from decomposed than from undecomposed ores and that decomposition appears to free the flake graphite in a manner impossible to duplicate mechanically.

Mechanical and pneumatic flotation machines give practically the same result, the former giving a slightly lower tailing product and the latter a slightly higher grade concentrate. The concentrate from the rougher cells will contain from 30 to 45 per cent carbon.

Three methods may be used to increase the grade of the rough concentrate: (1) Successive flotation, the tailing product being re-treated. (2) Stage grinding followed by flotation. (3) The use of concentrating tables. The first method is the simplest, but it is doubtful whether a high-grade concentrate can be produced. By the second method a high-grade concentrate can be produced, but the successive grinding of the tailing products causes the destruction of a large amount of flake graphite. The use of concentrating tables appears best suited to general requirements, as theoretically the free flake can be removed and is therefore not destroyed in the regrinding of the tailing product from the tables. In practice, however, it is found to be difficult to completely break down the primary froth, and an oil streak which passes down the table with the head water results, which lowers the grade of the table concentrate. A careful selection of the flotation oil may help reduce the loss.

By means of any of the above methods a concentrate containing from 65 to 85 per cent graphite carbon may be obtained, with 75 per cent a fair average grade. The first method is applicable to soft friable ores. With undecomposed gneissic ores the second and third, either separately or in combination, may be used with good results. The first and the third methods yield a higher proportion of No. 1 flake, while the second probably results in a higher grade combined concentrate.

The results that may be obtained by the use of the flotation process have resulted in a distinctly optimistic trend of thought regarding the graphite industry, but it must be pointed out that the industry on this continent has suffered through the acceptance of theory alone as a basis of mill design. The application of the flotation process to graphite ores is not a simple thing and the easy acceptance of theory may result in failure. Each step in the process should be proved to be satisfactory by mill-scale tests, and the advisability of testing cannot be too strongly emphasized.

Easton, Pa., Sewage Disposal Plant.—Bulletin 200 of the National Lime Association contains a description of a sewage disposal plant at Easton, Pa., which has been in successful operation for two years. The raw sewage is first screened, and then passed into an inclosed cypress tank in which are placed electrodes made of mild steel plates 10 x 16 x ⅜ in. arranged in banks of forty-eight with revolving paddles between the successive pairs of plates. The tank is provided with vents to remove gaseous products, and lime is added to keep the electrodes in a "passive condition" to conduct the current, making possible the liberation of nascent oxygen, and to aid in precipitating the organic material. The advantages claimed are direct, positive and controlled operation of the process, efficiency in the destruction of solid organic material and that the disinfection and purification of the effluent are high. The plant may be located in a vacant lot within the city limits, thus avoiding the need of long trunk sewers and the attendant expense and debt. The Easton plant is said to be on a residence street within the city, and to give no offense to adjoining property owners.

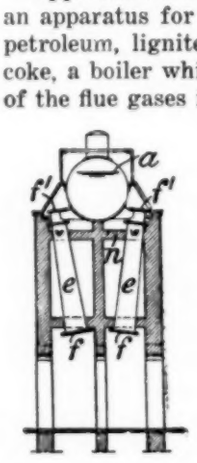
Recent Chemical & Metallurgical Patents

British Patents

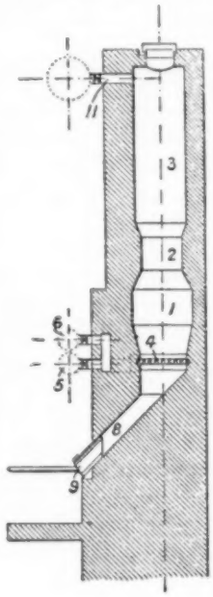
Complete specifications of any British patent may be obtained by remitting 25c. to the Superintendent British Patent Office, Southampton Buildings, Chancery Lane, London, England.

Refining Lead.—A process for dezinking lead consists in heating the molten lead with a molten mixture of an alkali chloride and a substance which lowers the melting point of the alkali chloride, e.g. a caustic alkali, or zinc chloride in the presence of a source of oxygen such as air or litharge. The treatment of lead with a mixture of zinc chloride and litharge is also referred to. (Br. Pat. 142,315—1919. H. HARRIS, London, June 30, 1920.)

Apparatus for Distilling Heavy Hydrocarbons.—In an apparatus for distilling heavy hydrocarbons such as petroleum, lignite tar and coal tar, and for producing coke, a boiler which is not exposed to the greatest heat of the flue gases is formed with a number of extensions forming retorts on which the fire gases play, the dimensions of the boiler and retorts being such that the solid residue to be coked resulting from the distillation of a charge which fits the whole apparatus is just sufficient to fill the retorts. In the arrangement shown in the accompanying figure the retorts *e*, which are preferably of conical form as shown, are attached to the bottom of the boiler *a* by horizontal branches and are furnished with cleaning doors *f'* above and discharge doors *f* below. In another form the retorts are attached directly to the boiler and cleaned from within it. Brickwork *n* shields the boiler from the direct heat of the fire gases, but it may be heated by gases escaping to the main flue. The portions of the retorts *e* in the fire-gas chamber are preferably connected to the upper part by flanges, so as to be easily detached for repair. In a modification each retort is connected to a separate boiler chamber with pipes and valves for filling and leading away gas, an arrangement of dampers being provided for regulating the supply of heat to the various retorts. Steam may be injected into the bottom of the retorts to equalize the heating of the liquid. (Br. Pat. 142,376—1919. L. STEINSCHNEIDER, Brunn-Königsfeld, Czechoslovakia, June 30, 1920.)



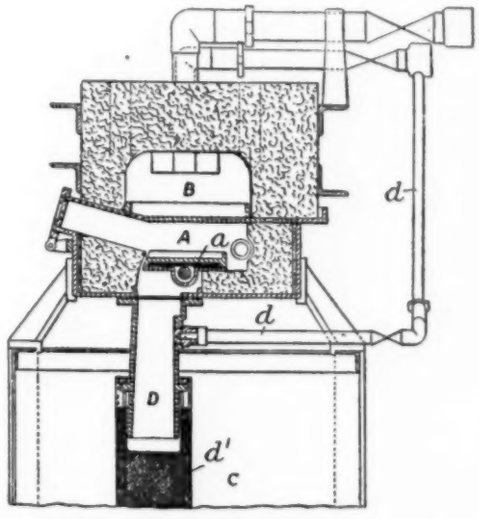
Destructive Distillation Furnace.—Relates to a vertical shaft furnace for the distillation of asphalt rock, bituminous slate, etc., for producing oil, of the kind in which the distillation is carried out in part of the same chamber as that in which combustion of a part of the material takes place. The furnace comprises a vertical channel 3 having a restricted cross-sectional area 2 at or near the center part for a combustion zone and a lower heat recovery zone 1 of comparatively large depth and diameter. Tuyeres 4 are provided at the bottom of the lower zone which communicate with two channels 5, 6 to supply air for combustion and steam or gas respectively. The heat recovery zone 1 narrows downwardly to the shoot 8, which is closed by a shutter 9. The gases from distillation and combustion are withdrawn through a pipe 11. (Br. Pat. 142,541—1919. A. LA PORTA, Rome, and R. BARTOLOMEIS, Milan, Italy. July 7, 1920.)



Aircraft Fabrics.—A process for preparing impervious fabric for airships consists in treating a fabric of cotton or other fabric having cellulose as its principal constituent by suitable chemical means to convert the cellulose partly or wholly into cellulose acetate, then treating with softening agents, such as triacetine or castor oil, and finally calendering. Any ordinary method of acetylation may be used. For example, the fabric is treated for several hours, at a temperature below 50 deg. C., with double its weight of mixture consisting of 5 to 6 parts acetic anhydride, 4 to 5 parts glacial acetic acid, and 1 part fused zinc chloride. After treatment with the softening-agent and calendering, the fabric may be coated with cellulose-acetate or like dope, and varnished. (Br. Pat. 142,615—1919. VICKERS, LTD., and Sir J. MCKECHNIE, Westminster, and A. RYAN, Oldham, Lancashire, July 7, 1920.)

Monoazo and Primary Disazo Dyes.—Monoazo and primary disazo dyes are obtained by coupling one or two molecular parts of a diazotized *o*-aminooxyarylsulphonamide of the formula $(OH)(NH_2)R—SO_2NHX$ (R = aryl or substituted aryl, X = hydrogen or aryl), or one molecular part of such a diazo compound and one molecular part of an aromatic *o*-oxydiazo compound, with one molecular part of an N-substituted derivative of 2 : 5 : 7-aminonaphthol sulphonic acid, such as phenyl-2 : 5 : 7-acid, benzoyl-2 : 5: 7-acid, *m*-aminobenzoyl-2 : 5 : 7-acid, the urea of 2 : 5 : 7-acid, 5 : 5'-dioxy-2 : 2'-dinaphthylamine-7 : 7'-disulphonic acid, or the urea of *m*-aminobenzoyl-2 : 5 : 7-acid. The products are substantive cotton dyes, and may be converted in substance into copper compounds by treating the solutions of dyes with copper or copper compounds, or by coupling the dye components in the presence of copper or its compounds; the copper compounds may also be produced on the fiber by after-treatment with copper salts of the direct dyeings or prints of the dyes, or by dyeing or printing with the dyes in the presence of a copper salt; the copper compounds give bordeaux to violet shades on cotton. Examples are given of the preparation of: a monoazo dye from 6-nitro-2-amino-1-oxybenzene-4-sulphonamide and phenyl-2 : 5 : 7-acid; a disazo dye from two molecular parts of 2-amino-1-oxybenzene-4-sulphonamide and 5 : 5'-dioxy-2 : 2'-dinaphthylamine-7 : 7'-disulphonic acid; a disazo dye from two molecular parts of 2-amino-1-oxybenzene-4-sulphonamide and the urea of 2 : 5 : 7-acid; a disazo dye from two molecular parts of 2-amine-1-oxybenzene-4-sulphonanilide and the urea of 2 : 5 : 7-acid; a disazo dye from 2-amino-1-oxybenzene - 4 - sulphonamide, 2-amino-1-oxybenzene-4-sulphonic acid, and 5 : 5'-dioxy-2 : 2'-dinapthylamine-7 : 7'-disulphonic acid. (Br. Pat. 142,448—1919. GES FÜR CHEMISCHE INDUSTRIE IN BASEL, Basel, Switzerland, July 7, 1920.)

Metal Heating Furnace.—A furnace for hardening or tempering small metal articles in a non-oxidizing atmosphere comprises a heating-chamber *A* separated from the combustion chamber *B* and having beneath it a chute *D* through which articles tipped or dislodged from the hearth will fall into the quenching-bath *C* without being exposed to the air. The hearth *a* is preferably pivoted as shown, or it may be mounted to slide, the articles being dislodged by a fixed rake; or where the hearth is fixed, a movable rake may be used to discharge the articles into the quenching-bath. Combustible gas is supplied to the chute *D* and heating-chamber *A* through the connection *d*, and openings may be formed in the roof of the heating-chamber through which part of the gas may enter the combustion chamber. A basket *d'* supported by the chute is provided to receive the discharged articles, and a screw pump may be fitted to maintain circulation of the liquid in the quenching-bath. The furnace is gas-fired, preferably by a burner of the kind described in Specification 110,960. (Br. Pat. 142,671—1919. H. W. YATES, Birmingham, and S. N. BRAYSHAW and E. R. BRAYSHAW, Manchester, July 7, 1920.)

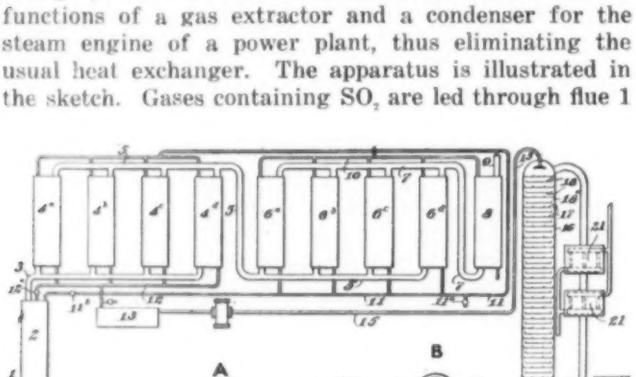


Enamels.—Enamels are made, without boron, lead, arsenic, milk glass or opal glass, from a mixture of silicates of alumina, soda, and lime and fluorides, fused and ground, coloring matter such as metallic oxides being added during the grinding process. Carbonate of ammonia may be added if desired, and the composition so obtained is applied to articles and heated to temperatures ranging between 800 and 1,050 deg. C. The limits between which the proportions of the ingredients may be varied are given. (Br. Pat. 142,688—1919. C. MUSIOL, Brussels, July 7, 1920.)

American Patents

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commissioner of Patents, Washington, D. C.

Recovery of Sulphur Dioxide From Furnace Gases.—A. H. EUSTIS, of Milton, Mass., has been granted two patents covering a method and an apparatus for the recovery of sulphur dioxide from smelter smoke and other gases. The method consists essentially of absorbing the sulphur dioxide from the gases in water, from which it is liberated by heating the solution. The sulphur dioxide is then condensed by pressure and cooling. The principal objects of the invention are to protect from corrosion the pumps by which the gases are handled; to utilize a portion of the liquid SO_2; to remove substantially the last traces of moisture from the gases, thereby eliminating dessicators for drying the gas, and to combine in a vacuum chamber the functions of a gas extractor and a condenser for the steam engine of a power plant, thus eliminating the usual heat exchanger. The apparatus is illustrated in the sketch. Gases containing SO_2 are led through flue 1



to the hot tower 2, the principal function of which is to cool, clean and enrich the gases. From the tower 2 the gases pass through flue 3 into scrubbing towers 4*a* to 4*d* in parallel, thence by flue 5 to scrubbing towers 6*a* to 6*d* in parallel, thence by flue 7 to lime tower 8, and thence by flue 9 to the atmosphere. The towers are all of similar construction and all except tower 8 are filled with coke or other insoluble material. The limestone or other soluble material in tower 8 increases the capacity of the liquid to absorb SO_2.

Water is fed to the scrubbing towers of the 6 group and to the tower 8 through pipe 10. The water from tower 8 may be wasted or fed to scrubbers of the 4 or the 6 group. The water from the towers of the 6 group is disposed of in three ways; part of it may be delivered through valve 11*b* to the top of the hot tower 2, when it will be heated by the incoming gases and give up its SO_2; part will be used to supply the towers of the 4 group and part wasted through valve 11*a*. The solution from the 4 group is collected in pipe 12, part being delivered through valve 12*a* to the hot tower 2, the remainder being delivered to a storage tank 13.

From the tank 13 the solution is pumped through the pipe 15 to the top of the chamber 16, the upper part of which constitutes a douche tank to cool the gases and the lower part of which constitutes a vacuum extractor. The tank is provided with a series of perforated shelves, 17 and 18, designed as shown at *A* and *B*. The descending solutions are subjected in the lower part of the tank 16 to the combined effect of heat and vacuum by which the SO_2 gas is liberated from the liquor. The heat is supplied by exhaust steam from the steam engine 23, the vacuum being produced by pumps 24*a*, 24*b* and 24*c*. The concentrated SO_2 gas passes through the coolers 21, to the pump 24*a*, through cooler 26*a*, to pump 24*b*, through cooler 26*b*, to pump 24*c*, and through cooler 26*c* to the cooling chamber 30. The repeated compression and cooling of the gases progressively removes the moisture and effects a saving of power. A further advantage is that it is possible to keep the temperature of the pump above the dew point of the gases and thereby prevent damage to the pump. If a single stage compression be used instead enough heat is generated by the compression to necessitate water cooling of the pump and this cooling is liable to cause condensation of SO_2 on the walls of the pump with resultant damage thereto.

The cooled and dried gases from cooler 30 pass through pipe 31 to pump 32 and are delivered to condenser 33 through the trap 35, which contains liquid SO_2 and acts as a dessicator to absorb the last traces of moisture from the gas. The trap is filled with coke and is cooled by the water coil 35*b* to such temperature that a portion of the SO_2 is liquefied. The liquid SO_2 from the trap is blown into cooling chamber 30 through pipe 36, when by expansion it refrigerates the cooler and gives up at least a portion of the moisture, which is removed through valve 30*a*. The pumps are provided with jackets for the purpose of keeping the walls above the dew point temperature and thus prevent corrosion. (1,341,114; May 25, 1920.)

Use of Oil in Drying Ores.—Certain iron ores found in parts of the Mesaba region and in other parts of the country contain a high percentage of moisture and are so lean that practically all of the moisture must be removed to raise the iron content of the ore to a commercially workable percentage. In drying these ores it has been found that at about 7 per cent of moisture the ores become so dusty that they cannot be transported or used in a blast furnace without undesirable loss. GEORGE L. COLLORD has found that if an oleaginous material such as tar or some form of petroleum be added to the moist ores, either before or while drying, such oil will spread over the ore particles and form a protective coating on all of the particles of the ore, and when so coated the percentage of moisture can be reduced to 3 per cent without the ore disintergrating in the process of drying. It has been found that 2½ to 3 per cent of oil or tar will be sufficient to coat all particles and that when the oil treated ore is dried to about 2 to 3 per cent of moisture the film coated materials will assume a granular form and will be entirely free from dust. (1,343,249; June 15, 1920.)

High-Speed Cutting-Tool Alloy.—Various combinations of elements may be made to produce alloys useful for specific purposes, and one invented by HUGH S. COOPER of Cleveland illustrates the possibilities in this direction. A high-speed cutting-tool that gives satisfactory service may be made by alloying zirconium, silicon and aluminum with nickel in the following proportions: Zr, 0.5 to 2 per cent; Si + Al, 2 to 8 per cent; the remainder of the alloy being Ni with small incidental amounts of iron, and, if desirable, tungsten. (1,350,359, assigned to the Zircon Tool & Alloy Corp.; Aug. 24, 1920.)

Current Events
in the Chemical and Metallurgical Industries

Chemical Exposition Opens in New York

Larger and more inclusive as to exhibits and more interesting as to program and entertainment than any of its five predecessors, the Sixth National Exposition of Chemical Industries was formally opened in Grand Central Palace, New York, on Monday, Sept. 20, with an address by Dr. Charles H. Herty. He was followed by Dr. Charles L. Reese, chief chemist for the du Pont company, who spoke on "Co-operation in the Industries." Dr. Reese drew attention to the paramount importance of co-operation among all interests concerned in the chemical industry. He pointed out as an example the fact that although exact measurements are the very foundation of chemical science, yet these measurements are made by physical instruments prepared by those who are not chemists. As a consequence co-operation between chemists and manufacturers of physical apparatus for controlling chemical processes is an outstanding necessity. The mutual benefit to be derived would be welcomed by both the chemist and the equipment maker. Dr. Reese stated that a beginning had been made in this direction by the association of some of the large chemical manufacturers of the country for the purpose of deciding upon standard specifications for certain chemical equipment, particularly thermometers.

The speaker also pointed out the value of co-operation among chemists in exchanging information and in concentrating on the solution of fundamental problems which are of interest to the entire profession. As an example he cited the need for material which resists aqueous hydrochloric acid at high temperatures. This is but one of the many problems which he thought would be solved if there were closer co-operation.

Problems confronting the American exporter were discussed by Erastus Hopkins of Gaston, Williams & Wigmore, Inc. Mr. Hopkins' paper dealt generally with a few fundamental suggestions which relate not only to chemical export trade but to American trade in general. He criticized the American selling organization for not studying the successful methods of other countries, such as England and Germany. This is believed to be necessary because Americans are not in any sense colonists nor do they have the foreign outlook as do the English and the Germans. He emphasized the necessity of shipping goods which meet exactly the specifications of the buyer, this being one phase of the service which must be rendered. Another phase is promptness in delivery. The speaker touched upon the matter of packing goods for export and contrasted the methods of English and American manufacturers in this respect. In the matter of financing the American exporter still has much to learn. Business cannot be done on a cash basis and the manufacturer must bear his share of the burden of financing his export business.

The fuel symposium, which was held Tuesday afternoon, Sept. 21, was devoted to the subject of fuel conservation and methods of getting additional energy out of the country's fuel supply. A full report of this symposium will be given later.

The motion picture programs are an excellent feature of the Exposition and will do much toward giving the public a sense of the importance of the chemical industry in the United States. Such films as modern packaging methods, the production of salt, the story of sulphuric acid and others are proving very attractive. Advantage is being taken of Exposition week for the gathering of several organizations, among them being the Chemical Warfare Post of the American Legion, the chemical fraternity Alpha Chi Sigma, and the American Institute of Chemical Engineers. The complete story of the Exposition and report of the technical sessions will be given in our issue for Oct. 6.

American Foundrymen's Association Meeting

The 1920 convention and exhibition of the American Foundrymen's Association, together with the Institute of Metals Division of the A.I.M.E., will be held at Columbus, Ohio, during the week of Oct. 4.

The tentative program contains many interesting and important papers to be presented on various aspects of Gray Iron, Non-Ferrous Practice, Steel, Industrial Relations, Metallography and Malleable Iron. Among these are "A Note on the Electric Furnace and the Problem of Sulphur in Cast Iron," by George K. Elliott; "Steel Making," by James W. Galvin; "The Triplex Process of Making Malleable Iron," by H. A. Schwartz, and "Approved Methods of Testing Molding Sand," by S. W. Stratton.

The convention will close Friday, Oct. 8, with an important exhibition by about 200 exhibitors of equipment and products, and a big meeting with the Electric Furnace Association.

Minerals Separation, Ltd., Appeals Case

Minerals Separation, Ltd., has appealed from the recent decision of Judge Morris, of the U. S. District Court of Delaware—the decision upon which that judge had based his various orders dismissing the different contempt proceedings through which Minerals Separation has unsuccessfully attempted to have Miami Copper Co. declared in contempt of court for continuing the use of its flotation process. By this new proceeding Minerals Separation now seeks to bring its assertion of contempt before the U. S. Circuit Court of Appeals in Philadelphia.

American Tar Products Co. Sold

The Koppers Co. and the Aluminum Co. of America, both of Pittsburgh, have jointly purchased the American Tar Products Co. and will operate it together. It is planned that operations shall include manufacture of electrodes for the use of the Aluminum Co., as well as a continuance of the general tar-refining work.

Cleveland Meeting of the American Electrochemical Society

The thirtieth general meeting of the American Electrochemical Society will be held in Cleveland Sept. 30, Oct. 1 and 2, 1920, under the auspices of the local members and the courteous co-operation of the Cleveland Engineering Society and the Cleveland Section of the American Chemical Society. Headquarters will be at the Hotel Statler. The morning sessions of Thursday, Sept. 30, and Saturday, Oct. 2, will be held in the ballroom of the hotel, but the session of Friday morning, Oct. 1, will be held in the physics lecture room of the Case School of Applied Science. An excellent technical program has been arranged as well as visits to plants of the Cleveland Instrument Co., U. S. Malleable Castings Co., Ohio Chemical Co., Cleveland Metal Products Co., Guide Motor Lamp Co. and Western Reserve Chemical Co. The social features will comprise a complimentary smoker in the ballroom of the Hotel Statler Thursday evening, Sept. 30, and an informal subscription dinner and dance in the ballroom of the hotel Friday evening, Oct. 1. Special arrangements have been made for the entertainment of visiting ladies. A feature of the meeting will be a visit to the Nela Park laboratories of the General Electric Co., where a special program will be arranged.

Lemon Growers Utilize Byproducts of the Lemon Industry

Another example of the way the chemists are conserving and economizing nature's resources is the work done at Corona, Cal., by the Exchange By-Products Co., which is owned and operated by the lemon growers of the California Fruit Growers Exchange. Large quantities of lemons which, because of their small size or some other good reason, would not be marketable and ordinarily a total loss have been salvaged and turned into profit. This byproducts plant is reported to have utilized ninety-four tons of lemons a day during the month of July and to have prepared and made use of 15,000 gal. of lemon juice per day during this time.

United States Not to Buy German Drugs

No German chemical drugs manufactured during the first half of the current year are to be purchased by the United States from stocks impounded in Germany. This applies to the synthetic organics of commerce and to practically all of the German patented products. The United States retains its right to make purchases during the next four and one-half years on the possibility that the present sufficiency of chemical drugs might not be obtainable from domestic sources. The statement in this connection issued by the War Trade Board Section of the Department of State follows in its entirety:

> The Reparation Commission has offered to this Government the right to participate in the purchase of certain chemical drugs from stocks impounded in Germany as well as from subsequent production of German manufacturers, rendered available to the commission by the Treaty of Versailles.
>
> From the records in possession of the War Trade Board Section it would appear that practically all these chemical drugs are now being manufactured in this country. They are available to the American consumer on reasonable terms as to price, quality and production. Reliable reports indicate the domestic product is equal to the German in quality; that the average price is substantially the same as that asked by the German manufacturers for stocks of current production, and that these drugs are manufactured in this country in quantity sufficient to meet all indicated domestic demand. The foregoing covers not only synthetic organics of commerce but likewise practically all of the German patented products.
>
> From the foregoing it would seem that there is no present need or demand in this country for these chemical drugs of German manufacture. For this reason this Government does not feel it advisable to take active steps to place upon the market foreign-made drugs which would compete with those of domestic manufacture and therefore will not exercise its option upon impounded stocks of chemical drugs of German manufacture or upon stocks of chemical drugs manufactured during the months of January, 1920, to June, 1920, inclusive.
>
> This Government will, however, retain its right to participate in allotments from future daily production of chemical drugs which may be manufactured by Germany during the next four and one-half years, in view of the possibility that a need in this country may arise at some future time for certain chemical drugs which may at that period be unobtainable from domestic sources.

Pulp Situation at Holyoke Mills Easier

The general improvement in traffic conditions has eased the pulp situation in the Holyoke district. As there is but one pulp mill in the immediate vicinity, the mills are absolutely dependent on the railroads and consequently any impairment in service is felt immediately. Shutdowns of a day or two at a time caused by lack of pulp were common through the early part of the summer. The larger companies, by rationing each car of pulp consigned to them, were able to keep their divisions operating.

In common with the rest of New England, Holyoke has suffered from the coal shortage. The mills are for the most part operated on water power but of course depend on coal for raising what steam is needed, and supplies have been very short. The local gas and electric company has barely been able to keep going by borrowing needed coal from the local mills fortunate enough to have a surplus and from nearby cities where a carload or so at a time could be picked up.

Conference of Color Committee of Cottonseed Oil Chemists

A conference dealing with the color standardization of oils was held at the Bureau of Standards on July 30 and 31. The entire subject was discussed in detail, including the use of technical terms, the present difficulty in getting instrument makers to turn out the required apparatus, and a demonstration of the methods used in color grading oils by the optical division of the Bureau. The new apparatus recently designed for this purpose was demonstrated and a great deal of time spent in familiarizing the committee with the use of the instrument. Data secured were compared with the results obtained from the Arons chromoscope in terms of Lovibond numbers. Data were also secured on some of the samples by means of the Koenig-Martens spectrophotometer.

Memorial to Lord Rayleigh

The Rayleigh Memorial Committee has decided that the mural tablet to the late Lord Rayleigh, which is to be placed in Westminster Abbey, shall be erected in close proximity to the memorial to Sir Humphry Davy. As there will be a balance remaining after all expenses have been met, it is proposed that this shall be used to establish a library fund at the Cavendish Laboratory, Cambridge.

Philadelphia Section Meeting, A. C. S.

The first meeting of the Philadelphia Section, American Chemical Society, for the 1920-21 season, was held at the Engineers' Club Thursday evening, Sept. 16.

For the benefit of those members who were unable to attend the sixtieth meeting of the Society at Chicago, Dr. R. P. Fischelis outlined the general features of the meeting, devoting particular attention to matters discussed at the Council meeting. An item of local interest was the change in name of the Carney's Point Section to the South Jersey Section.

Dr. W. A. Pearson announced that Sydney Davis has found it impossible to continue as editor of the *Catalyst*, owing to business interests which require his full time outside of Philadelphia. A vote of thanks was tendered Mr. Davis and Dr. Fischelis, managing editor of the *Catalyst*, who is to leave Philadelphia in the near future. In order to fill these vacancies, Dr. Henry Leffmann will be asked to accept the position of editor and Dr. Joseph S. Hepburn that of associate editor.

Nitrocellulose

Hugo Schlatter, chief of the Chemical Products Division, Hercules Powder Co., reviewed the development of the nitrocellulose industry, which dates from Schönbein's discoveries in 1846, and then discussed the chemistry, manufacture and uses of nitrocellulose.

Chemistry of Cellulose

The product obtained by treating cellulose with mixed acid is a true ester and not a nitro compound, so that we should speak of cellulose nitrate and not nitrocellulose. The products obtained are not definite compounds since the raw material—cellulose—is complex. In nitrocellulose work, n in the formula $(C_6H_{10}O_5)_n$ is taken as 4. Of the structural formulas, that of Green best explains the formation of dextrose and brom-methyl-furfural. Hibbert's formula consists of a 5- and a 6-membered ring (instead of the 5- and 7-membered ring of Green) and exp'ains polymerization. Our knowledge of the cellulose molecule is, however, still very meager.

Manufacture of Nitrocellulose

The chief source of cellulose for nitration is cotton linters. These are cleaned, freed from oil by boiling under pressure with 2 per cent NaOH solution (in the absence of air, which would form oxycellulose), dried to less than 1 per cent moisture and then treated with mixed acid, the composition of which varies according to the product desired. The nitrated products have the formula $C_{24}H_{40-n}O_{20-n}(ONO_2)_n$, where n may vary from 1 to 12, although only those nitrocelluloses in which n is 7 or over are of commercial importance. As a general rule, nitrocellulose containing over 12 per cent N is insoluble in ether-alcohol and is used as guncotton, while when the nitrogen content is below 12 per cent the product is suitable for the manufacture of pyroxylin plastics.

The modern system of manufacture consists in treating the cellulose in small batches in dipping pots which discharge to centrifugals on the floor below. These in turn discharge into washing bowls provided with a tangential flow of water. It has been found that instability of the product was due to the presence of nitration products of impurities in the raw cellulose. These are broken up by boiling with water containing a little acid. The material is next passed through beating engines, which reduce the fibers so that they will pass through 0.01-in. slits. A final boiling or "poaching" serves to remove the last traces of acid from the capillary fibers. After drying to 30 per cent moisture in centrifugals, the nitrocellulose is placed in hydraulic presses having a perforated plate through which alcohol is forced, to displace the water in the nitrocellulose. The alcohol is then removed by a pressure of 3,500 lb. per sq.in.

The speaker concluded with a summary of the varied uses of nitrocellulose for military and industrial purposes.

Discussion

In reply to a question by Dr. E. E. Marbaker as to the difference between high and low viscosity cottons, Mr. Schlatter said that the viscosity could be varied over a wide range through the proper choice of solvents coupled with the use of diluents or non-solvents. Solutions of very high viscosity are obtained when non-solvents are added in amounts just insufficient to cause precipitation. This phenomenon is the basis of one of the methods for preparing solid alcohol. Viscosity is determined with sufficient accuracy for practical purposes by noting the time required for a steel ball to fall 10 in. in a vertical tube filled with the solution to be tested. This time may vary from 5 to 1,200 sec.

Dr. Marbaker also inquired as to the cause of "blushing" or the appearance of opaque, poorly-adherent spots in the coating of split leather when dopes containing highly volatile solvents are used. Mr. Schlatter said that this was due to the relatively greater hygroscopicity of such dopes and to the fact that the rapid evaporation of the solvent often cools the surface below the dew-point of the surrounding atmosphere so that moisture condenses on the coating, causing precipitation of the nitrocellulose.

Ceramic Day at the Chemical Exposition

The American Ceramic Society is occupying Booth 750, on the fourth floor, at the Sixth National Exposition of Chemical Industries, Grand Central Palace, New York City. A program of diversified interest will be given on Ceramic Day, Friday, Sept. 24, at 2 p.m. In the evening of the same day moving pictures will be shown of different phases of the ceramic industry. Members and persons interested are invited to register at the booth, where the Society's literature may be examined, orders left, application blanks obtained, etc. The assistant secretary will be in attendance each day to give information and to receive registrations and memberships.

Another Platinum Theft

The following pieces of platinum were recently stolen from the chemical laboratory of the United States Smelting, Refining & Mining Co., at Midvale, Utah:

Cylinders	No. on Cyl.	Size of No. on Cyl. In.	Wt. of Platinum, G.	Size of Cylinders
1 (B & Co. on stem)	6	1/4	17.0008	4½ in. x 2 in.—5¼ in. stem
1 (B & Co. on stem)	31	1/4	15.6975	4½ in. x 2 in.—5¼ in. stem
1 (B & Co. on stem)	25	1/4	15.4663	4½ in. x 2 in.—5¼ in. stem
1 (B & Co. on stem)	29	1/4	15.6608	4½ in. x 2 in.—5¼ in. stem
1 (B & Co. on stem)	1	3/16	11.50	3¾ in. x 2 in.—4 in. stem
1 (B & Co. on stem)	3	3/16	11.50	3¾ in. x 2 in.—4 in. stem
1 (B & Co. on stem)	5	3/16	11.50	3¾ in. x 2 in.—4 in. stem
1 (B & Co. on stem)	6	3/16	11.50	3¾ in. x 2 in.—4 in. stem
1 (B & Co. on stem)	7	3/16	11.50	3¾ in. x 2 in.—4 in. stem
1 (B & Co. on stem)	9	3/16	11.50	3¾ in. x 2 in.—4 in. stem
9 Spirals			about 6 g. each	4½ in. long—⅞ in. flat coil
2 Crucibles			about 20 g. each	
2 Crucible covers			about 5 g. each	
3 Filtering cones			about 2 g. each	

Imports and Exports of Chemicals

Exports of chemicals during the seven months ended with July ran well ahead of the corresponding period of 1919. The value of chemicals exported during the first seven months of 1920 was $106,633,166, as compared with $75,299,068 for the first seven months of 1919. These figures are taken from the returns to the Bureau of Foreign and Domestic Commerce, which has just completed the compilation of the July returns.

In July, the value of chemicals exported was $13,775,972, as compared with $7,642,735 in July of 1919. The sodas contributed greatly to the increase. Sodas were exported in July, 1920, to the value of $2,133,239. The principal increase was in caustic soda exports. Dyes and dyestuffs also increased markedly. Exports in July, 1920, were valued at $3,018,188, as compared with $872,091 in July of 1919. France, Italy, the United Kingdom, Canada, China and Japan were the destinations of greatly increased quantities of dyes.

While the exports of acids were light, valued at $426,340, there was a very marked increase in exports of sulphuric acid. The exports of extracts for tanning fell off slightly, totaling for July, 1920, $234,310.

Imports of chemicals more than doubled in July, 1920, as compared with those of July, 1919. The total value of chemicals imported without the payment of duty in July, 1920, was $11,249,624, compared with $3,816,142 in July of 1919. The value of the dutiable chemicals imported in July, 1920, was $6,640,706. In July, 1919, the imports of dutiable chemicals were valued at $4,696,731. Of particular significance were the imports of gums. In July, 1920, gum arabic, camphor, chicle, copal, gambier, shellac and other gums were imported to the extent of 18,162,380 lb. Potash imports also were heavy, aggregating 3,394,208 lb. The principal item making up the total was cyanide of potash.

Figures covering chemicals of lesser importance are as follows:

IMPORTS OF CERTAIN CHEMICALS

	July, 1919 Lb.	July, 1920 Lb.
Arsenic, and sulphide of	398,291	993,558
Indigo:		
Natural	1,736	none
Synthetic	9,311	164,676
Iodine	83,257	none
Lime, chloride of	101,378	140,562
Lime, citrate of	220,815	781,933
Potash, carbonate of	71,627	794,909

EXPORTS OF CERTAIN CHEMICALS

	July, 1919 Lb.	July, 1920 Lb.
Glycerine	67,980	113,636
Lime:		
Acetate of	908,546	1,388,972
Chloride of	652,226	3,656,024

Appropriations for Chemical Work

No great difficulty is expected in convincing Congress at the next session that more appropriations must be forthcoming for work of interest to the chemical industry. While it is expected that the next Congress will be more generous than the last, information reaching Washington is that the chemical industries are prepared to present such convincing facts and figures as to make a favorable decision in the matter by the Appropriations Committee practically certain. The Appropriations Committee will be shown that from 1914 to 1917 there was an increase of 182 per cent in the volume of business done by the chemical industries. In 1910 the value of exports of thirty-six classes of chemicals aggregated $21,500,000. In 1917 the exports of these same classes of chemicals aggregated $193,000,000. In 1910 imports of seventy-six different groups of chemicals aggregated $76,500,000. This amount was increased to $144,000,000 in 1917. In 1910 the United States imported $55,000,000 worth of chemicals more than were exported. In 1917 the exports exceeded the imports by $49,000,000.

It also will be pointed out at the next session that the expansion of the chemical industries antedated the war. During the period from 1904 to 1914 the average increase in the value of products of fourteen leading industries was 63.9 per cent. During the same period the value of the products of the chemical industries increased 86.1 per cent. Among the fourteen industries the expansion in the chemical industry was exceeded only by that in the vehicle industry.

It is believed that it will not be difficult to impress upon Congress the enormity of the achievement of the chemical industry in meeting the chemical needs of the country throughout the war, when it was called upon almost over night to take care of needs which previously had been supplied from abroad. This was done in spite of the intricate character of most chemical manufacturing processes.

It is taken for granted that Congress is unanimous in the desire to prevent the decadence of this new industry, but the Appropriations Committee will scrutinize closely any proposed expenditures to assist the industry in holding its own. It will be pointed out to the committee, however, that the maintenance of these great business enterprises, when subject to peace-time competition, will depend to a considerable degree on their efficiency, and that a great number of problems will have to be met if the various advantages held abroad are equalized. There is reason to think that Congress will be ready to lend its aid to end the old practice of exporting the raw materials from which chemicals are made and buying back the finished products at greatly enhanced prices.

Chicago Meeting of the National Association of Purchasing Agents

The National Association of Purchasing Agents will hold its annual convention at the Congress Hotel, Chicago, Oct. 11, 12 and 13. Business sessions will be held on each of those days, the convention being open to all industrial purchasing agents.

At the morning session on Oct. 11 the work of the association in establishing standards of business practice and in national legislative matters will be reviewed. At all other sessions there will be addresses and discussion. Some of the speakers on the program are Russell A. Pettengill, of the Russell A. Pettengill Co., Chicago, on "Buying Through Specifications"; Prof. Irving Fisher, of Yale University, on "Stabilizing the Dollar"; Dr. F. W. Russe, of Mallinckrodt Chemical Works, St. Louis, on "Safeguarding the Purchase of Chemicals."

Visits of inspection will be paid by the delegates to the packing houses of Chicago and to the Great Lakes Naval Training Station.

On the evening of Oct. 11 the annual banquet of the association will be held, featuring speakers of national prominence.

The National Association of Purchasing Agents has a membership of 3,500.

American Engineering Council of the Federated American Engineering Societies to Meet

The first meeting of American Engineering Council of the Federated American Engineering Societies will be held in Washington, D. C., Nov. 18 and 19, 1920, with headquarters at the New Willard Hotel. All sessions will be held in the small ballroom.

Registration will begin at 8:30 a.m. Thursday, Nov. 18, and at 10 o'clock the opening session will be called to order by Richard L. Humphrey, chairman of the Joint Conference Committee. A temporary chairman and secretary will be elected and committees will be appointed on program, credentials, constitution and bylaws, nominations, plan and scope, budget, and resolutions. At the afternoon session J. Parke Channing, chairman of Engineering Council, will address the gathering on the work of that organization. This will be followed by a discussion of the field of activity for the Federated American Engineering Societies.

At 9 o'clock Friday, Nov. 19, the morning session will consider the report on the committee on nominations, election of permanent officers, report of committee on constitution and bylaws, formal ratification of same, and report of committee on plan and scope. At the afternoon session at 2 o'clock the committees on budget and on resolutions will make their reports. The evening session will meet at 8:30 to hear an address by Herbert Hoover, president of the American Institute of Mining and Metallurgical Engineers. This will be followed by an informal reception and smoker.

At 9 a.m. Saturday, Nov. 20, there will be an organization meeting of the executive board, American Engineering Council, of the Federated American Engineering Societies.

Personal

Dr. ARTHUR M. BUSWELL, who was formerly in the department of sanitary engineering at Columbia University, is now chief of the Illinois State Water Survey, Urbana, Ill., having succeeded Prof. Edward Bartow, who is now head of the chemical department of the University of Iowa, Iowa City, Iowa.

Dr. FARRINGTON DANIELS has resigned from the Fixed Nitrogen Research Laboratories, American University, Washington, D. C., to become assistant professor of physical chemistry at the University of Wisconsin.

Dr. J. E. DAY has resigned as assistant professor in Ohio University to accept a similar position with the University of Wisconsin, where he will teach inorganic chemistry.

HARMON E. KEYE, who was with the Consolidated Mining & Smelting Co. of Canada, is now chemist with the Electrolytic Zinc Works, Martinez, Cal.

Dr. R. E. RINDFUSZ has been appointed assistant to the president of the American Writing Paper Co., of Holyoke, Mass. Dr. Rindfusz has been chief of the research section of the company's department of technical control. Previous to his association with this company he was associate in organic chemistry in the University of Illinois and was identified with that institution's war work in the manufacture of rare organic chemicals.

H. H. STOEK has recently received the honorary degree of D.Sc. from the University of Pittsburgh.

A. E. WELLS, chief metallurgical engineer of the Bureau of Mines, has resigned to handle the mining and metallurgical problems of a large development company. His headquarters will be in New York.

Obituary

GEORGE A. BREWSTER, who had been chief chemist and metallurgist with the American Steel Foundries Co., Chicago, Ill., and the American Radiator Co., Buffalo, N. Y., and who had also held other positions in connection with the chemical industry, died on Aug. 17, 1920. Mr. Brewster was an active member of the American Chemical Society, the American Steel Treaters Society and the American Institute of Mining and Metallurgical Engineers, and had accomplished much in the way of development of special steels. He is survived by his wife and two sons.

JOHN R. COOPER, of Degolia, N. Y., who was part owner of the Newton Chemical Co., died on Sept. 3 following an operation.

Dr. WILLIAM HODGSON ELLIS, former dean of the faculty of applied science, Toronto University, died at Lake Joseph, Muskoka, Canada, on Aug. 23, 1920. Although Dr. Ellis was in his seventy-fifth year and had not been as active for the past year as his friends would have wished, his death came as a distinct shock to his colleagues of the university and to a host of graduates throughout Canada. For more than forty years Dr. Ellis had been on the teaching staff of Toronto University. He held various lectureships until 1887, when he became professor of applied chemistry at the school of practical science. He was later made dean of the faculty of applied science, from which he retired in May, 1919.

CHARLES WARREN MCCLURE, vice-president and general manager of the William B. Pollock Co., Youngstown, Ohio, died on Aug. 11, 1920.

Book Reviews

THE OIL-SHALE INDUSTRY. By *Victor C. Alderson.* 170 pp., illus. New York: F. A. Stokes & Co. Price, $4.

This book, gotten out "to meet the widespread demand for information of a comprehensive nature," contains a miscellaneous collection of facts, figures and views anent oil shale and the oil-shale industry. It comprises an elaboration and revision of material presented in the *Quarterly of the Colorado School of Mines* for October, 1919. Essentially popular in its nature, it adds nothing to present knowledge of oil shale of value to the engineer or chemist, but much of the information and many of the views presented will be of interest. The book should be in the hands of every person interested in the promotion of an oil-shale project.

After reviewing the critical petroleum situation, which points to the eventual utilization of oil shales, the extent of the world's deposits of oil shale and the history of the shale industry abroad are popularized and presented in pellet form. Many statements in the book are of doubtful accuracy. Chapters on "Retorting and Reduction" and on "Experimental Work" are included, which seem to have been hastily compiled from the popular press. For example, on page 52, we learn that all petroleum consists of hydrocarbons which "belong to one of two series—the parrafine or the olefine series." On page 54, we are told that a hydrocarbon "is primarily a compound of the elements carbon and hydrogen, but combinations of these two with other elements are not excluded." On page 93, experimental work of the United States Geological Survey is quoted, showing that the yield of ammonia obtained by steam distillation was approximately two and one-half times that obtained by dry distillation, while on page 61 we learn that "It is difficult to see how steam can aid in the formation of ammonia during the distillation of the oil by any chemical interaction."

While the possibilities of the oil-shale industry could hardly be exaggerated and indeed are not exaggerated by Dr. Alderson, his views as to the present status of the industry seem optimistic in view of the fact that all work done up to the present time, however valuable, has been confined strictly to pioneering on a small scale. A number of favorable reports upon the quality of shale oil have been included, and, however authentic these may be, due mention is not made of adverse reports. A method for the determination of oil and ammonia yields from oil shale is included which seems to have many excellent features. A very good bibliography is appended.

The difficulties of presenting information bearing on an industry so embryonic as the American shale-oil industry are, of course, great, and much should be excused in an attempt to describe such an industry. At the same time it seems ill advised to offer to the public a work purporting to convey "comprehensive information" upon a nonexistent industry. Especially is this true at a time when governmental agencies are investigating the subject, when many private agencies with conflicting interests and opinions are putting forth conflicting claims and when no technology exists to be described except the Scotch practice, which is presented in this work only in a very general and somewhat fragmentary manner. CHARLES L. JONES.

Current Market Reports

The Iron and Steel Market

Pittsburgh, September 17, 1920.

Demand for steel products, whether for prompt or for late delivery, continues notably light, and the situation is the more impressive from the fact that more than half of September has been passed, so that the dullness can no longer be ascribed to its being the midsummer period, which is always dull in the steel trade, but which the trade limits in its market analysis to the two months July and August.

As to forward commitments the dullness is ascribed to uncertainties both as to general business and as to prices of steel in particular. As a rule in steel, only a scarcity of material or the certainty that prices are going to be higher will bring the buyer into the market for forward commitments. As to prompt buying, the loosening up in the rail transportation situation is easily sufficient to account for the dullness. Production of steel has increased and the mills are now shipping more than they currently make, instead of less, as was the case in July and three months preceding. The stocks at mills are not cleaned up yet, but are probably reduced to not over one-half the maximum, which fell at about the end of July. Thus there has been a very material increase in receipts of steel by jobbers and manufacturing consumers. The prompt buying that occurred some time ago was not of regular character, but was largely by consumers who had steel due them on regular contracts but who were not receiving full deliveries. Accordingly they doubled up on purchases, buying prompt deliveries to eke out, and now when they receive deliveries from both sources of supply they are, generally speaking, well supplied.

Generalizations, however, are not exact in the matter of the various steel products. While there is no marked demand in the matter of making fresh purchases in any line, there remains considerable pressure on the part of buyers for deliveries against old contracts in several lines, including nails, tin plate and the smaller sizes of merchant steel bars.

STEEL PRODUCTION INCREASING

Here and there, it appears, a small mill is decreasing its operations on account of lean order books, but such cases amount to very little in the general average. The large mills have been increasing production as physical limitations, particularly the matter of transportation, permit. The report on ingot production made by the American Iron and Steel Institute covers the output of thirty producing companies which contributed 84 per cent of the 1918 total output and 85 per cent of the 1919 total output. The production of these thirty companies increased by 7 per cent from July to August, and the influences permitting larger production have continued. The rate of steel ingot production for the whole country in August may be estimated at about 42,700,000 gross tons per annum. October, usually a very favorable month on account of seasonal conditions, may easily show a rate of 45,000,000 tons.

While the steel market is described as stagnant, it must not be inferred that there is no buying and that no new commitments at all are being made. Scarcely any material is sought in the open market, but the mills are entering more or less tonnage from regular customers quite steadily, the volume being somewhat reduced. Thus the Steel Corporation had bookings in August equal to about two-thirds of its capacity, and its bookings this month may run at about the same rate. The corporation's unfilled obligations decreased by 313,430 tons in August, this being the first decrease reported since that for May, 1919, but the August decrease was equal to only about 23 per cent of the month's capacity, while shipments may be estimated at 90 per cent of capacity, indicating bookings at 67 per cent. July had shown an increase of 139,651 tons in unfilled obligations, equal to 10 per cent of capacity, and if shipments in July be taken at 75 per cent the bookings appear to have been about 85 per cent. The decrease in bookings from July to August is thus about 18 points, while the increase in shipments was about 15 points. With an increase of 139,651 tons in unfilled obligations in July and a decrease of 313,430 tons in August, there was a net change of 450,000 tons, nearly half of which change is attributable to an increase in shipments.

PRICES MAINTAINED

The large independent steel mills are maintaining their prices quite well. There is no disposition to quote prices in the open market lower than prices at which there are unfilled contracts on books, as the net result would be unsatisfactory. For a ton of new business thus secured ten tons of contract business might be jeopardized. Some paper advances recently made, however, have not held. Thus some mills that had sold plates at 3.25c. put their nominal asking price up to 3.50c., but now admit that if real business were offered they would be willing to accept it at 3.25c. To go a single dollar a ton below 3.25c., however, would be an entirely different matter.

Those of the smaller mills that have had prices far above the prices of the larger independents have been disposed to reduce prices, but this represents simply a decrease in delivery premiums. It is difficult to sell even at reduced prices, hence these smaller mills are faced with lower production rates.

As there is no longer any danger of a price advance by the Steel Corporation encouraging the independent steel market to engage in a fresh flight the corporation has relaxed a trifle of its rigidity in holding its prices down to the Industrial Board schedule, promulgated March 21, 1919. Last month the corporation adopted a new card on wire nails, practically conforming to the card adopted by the independents last February and increasing the extras on small sizes above the base price. Since then the corporation has advanced its price on rods $5 a ton, to $57, but as the independents are quoting $70 to $75 this goes but a short distance toward bridging the gap between corporation and independent prices. It is not certain that the corporation may not reduce some of its prices, its object apparently being to readjust its prices in relation to the cost of production of different commodities. The Industrial Board schedule, to which the corporation has adhered, was not an independent price structure, but was little more than the war control schedule reduced horizontally, while production costs now are not aligned with each other as they were during the war.

Pig iron is stagnant in nearly all districts and practically everyone now feels that the recent price advances were

carried too far, so that the next change in pig iron prices will be in the downward direction. As the merchant furnaces are well filled with business for the nearby future nothing may occur for a while.

The Chemical and Allied Industrial Markets

New York, September 17, 1920.

No improvement in the chemical market has been made during the period. The same "waiting" attitude noticed among buying interests for the past few weeks continues in vogue, with the result that business has been rather dull and in a small way whenever transacted. The shading of firm prices by second hands in an endeavor to obtain the cash with which to lay in stocks for the coming year has fallen off and producers' prices practically govern the market. On the whole former prices have been well sustained, but on the other hand there have been no advances, which seems to indicate that the market will continue in its present inactive condition until there is a better understanding between buyer and seller.

Many Items Weaker

The exceptions to the otherwise steady market are those which have been weakening for the past week or two. Among these is *caustic soda*, which has been offered as low as $4.50 by second hands, but the average price for the usual material is still around $5.50 per cwt., with buyers showing no inclination to invest. Another item that has been affected by the sluggish condition of the market is *oxalic crystals*, which is quoted on contract at 45@50c. per lb., compared with the recent quotations of 53@54c., and it is not beyond probability that this figure can be lowered to 40c. in the open market for second-hand supplies. Demand for *citric acid* having quickened, there is a decidedly firmer note to this item, although the price has remained the same, it being still possible to obtain material in carloads at 78@81c. per lb. *Potassium bichromate* continues brisk at 35c., with some quotations slightly below this figure and the supply keeping fairly well up to demand.

Coal-Tar Products

The change in this market, if it can be called such, is one of attitude rather than actual conditions, as prices are about the same and buying has not been greater than for the past few weeks. This change of attitude is principally on the part of producers who have taken a decidedly optimistic view of the coming season's business and look forward to a heavy year. Indications seem to justify this opinion, as the resumption of activity in the textile trade will beneficially affect business and besides increased activity in the paint industry is expected to be the order for next year. There is no doubt that this market has been as dull for the past few months, after last winter's heavy buying, as it has been for some years and a break was expected, arrived and now a return to better conditions is being looked forward to in the near future.

The only items worth noting are *dimethylaniline*, which picked up after the recent drop and is quoted at 95c.@$1.05 compared with 80@90c. of the previous report and also *H acid*, which showed some weakness and is in better supply, at $1.90@$2.05 per lb., than it has been for some time.

Naval Stores

No great advance has been made in this line, but conditions are improving and the principal reason back of this statement is the active return of foreign interests, especially England, into this market. The local situation has not improved to any extent, as difficulty is still being met in making shipments from the South. *Turpentine* held firm at the former $1.49 level, with practically no business reported.

Oils

The bottom having been reached, it is now supposed that there will be a general tightening up, especially in *cottonseed* and *linseed* and a gradual return to the normal conditions. *Soya bean*, f.o.b. N. Y., and *peanut oil* crude seem to bear this statement out, as the former is being held firmly at 14@14½c. and the latter at 17@18c. per lb. *Chinawood*, in bbl., f.o.b. Pacific Coast, is also stronger at 15¾@16c. per lb. than it was last week and it is predicted by some and hoped for by all that these facts, combined with the fact that crushers have arrived at the point where they cannot go any lower, indicate increased activity.

The Chicago Market

Chicago, Ill., September 15, 1920.

All lines of the chemical trade in this market show steady quotations, in spite of which the market must be termed uncertain. In general, there is a feeling of nervousness, holders of stock not appearing anxious to dispose of commodities on a weak market and consumers being wholly unwilling to pay the quoted prices in the face of possibilities.

Heavy Chemicals

The heavy chemical line shows nothing of interest. Producers of alkalis have not yet made public their price ideas for next season and trading is at a minimum pending this announcement. The same prices that have been quoted for the past month are still in effect, but actual buying is so slight as to render them practically nominal. It is felt that many of the few transactions going on are closed with the seller shading the price fractionally. *Alcohol* and *formaldehyde* are unchanged in price but, regardless of difficulty in securing goods, demand is weak. *Mercury* has kept pace here with the sharp reduction noted on both coasts, and is obtainable for $78 per flask. Producers' prices on chlorine, based on 9½c. factory, are firmly held, with considerable business being done.

Coal-Tar Products

Coal-tar products show a continuation of the lethargy which has enveloped them for many weeks. The recent partial shutdown in the textile industry deprived the line of its last vestige of life and it is surprising only that demoralization was not the result. All things considered, prices have held up remarkably well and with the gradual resumption of the textile mills, which even now is beginning, things should brighten up. The past seven-day period has seen no price changes of moment and few deals.

Fertilizers

Fertilizers are likewise weak. Unusually heavy fall rains have retarded agricultural operations, thus delaying consumers' buying of fertilizer materials. As between the producer and dealer, a disposition for watchful waiting is shown. Considerable finished product is accumulating in makers' hands, but no interesting price changes are reported.

Naval Stores

Indications are that price recessions in naval stores have reached their limit, at least for a time. Reports from the South are to the effect that export bidding is taking a share in stabilizing prices and locally demand is keeping even pace with supply. *Turpentine* shows a shade more strength, the current price in barrels, less than carlots, being $1.52 per gal. Jobbers are quoting to the consuming trade, in small lots, $1.75, but it is doubtful if this price is being adhered to rigidly. *Rosins* also show strength, quotations being ½ to 1c. higher, and all grades going at the same price. It is understood this item is particularly affected by export demand. *Pine oil*, in slightly better supply, is still quickly absorbed at the prevailing high prices by hungry consumers.

Vegetable Oils

There is a point in the price trend of all commodities which, when reached, will induce buying almost regardless of surrounding conditions. This same point seems to have been reached in the trading in vegetable oils. With indications of enormous supplies practically unchanged, prices showed a decided resistance to further hammering and considerable trading was indulged in, largely by the speculative element, as consumers still seem disposed to hold aloof.

A falling off in the estimated coming crop of flaxseed has caused plenty of bull talk in *linseed oil*, but the market failed to react. Tanks, for prompt and immediate delivery, f.o.b. Chicago, are quoted at $1.15 per gal., with post-September deliveries at $1.06@$1.07. In barrels 7c. is added. Jobbers' printed quotation to consumers in less than 5 bbl. is $1.45, but bona fide orders probably find a slightly lower level. There seems to be nothing in the flax outlook that points to higher prices.

Corn oil, at the current quotation of 8¾@9c. per lb., created wide interest, the price being low enough to cause buyers to come out of retreat. The slightest indication of an advance above 9c. was sufficient to stop trading, however, and that level seem fixed as the maximum for some days. Actual quotations on *cottonseed oil* show no change, prime summer yellow being quoted at 12½c. lb. in tanks, Chicago, and refined at 16½c. The consumer is remaining out of the market at these figures, even though the southern planters are protesting that the price is dangerously low.

Oriental oils remain quiet. *Coconut oil* is quoted at the coast in seller's tanks at 13½@13⅝c., current local price in barrels being 16@16½c. Transactions are few. *Soya bean oil* is held for 9@9½c. for prompt coast shipment, buyers' lack of response indicating that the consumer thinks it is still too high. *Chinawood oil* finds light demand at the f.o.b. Chicago price of 16½@16¾c., and *red oil* reflects the partial paralysis of the textile trade by registering no business on the low basis of 13c. per lb., Chicago, in tank cars.

The St. Louis Market

St. Louis, Mo., September 14, 1920.

The chemical market in this district has been quiet for the last month, there having been a slight easing-off of business over that of a month ago. Producers assert, however, that there is enough business to permit them to dispose of their entire volume without any danger of bearing down the market and that inquiries are coming in in good volume. Orders are well divided between those for immediate delivery and those for 1921 delivery. Prices have made no change during the past month, quotations made then having included increased costs due to the freight rate raises.

Chemical Supply Equal to Demand

The supply of chemicals on hand locally is, with the exception of *muriatic acid*, amply sufficient to meet the demand, but no price trend downward is noticeable, and the following quotations, based on carlots unless otherwise noted, are holding firm. There is a fairly good demand for *sulphuric acid* with prices steady. The 60 deg. grade is quoted at $16 per ton and 66 deg. at $24 per ton. There is slightly better demand for *oleum*, which is still quoted at $27.50 per ton.

Shortage of Muriatic Acid

A considerable shortage of *muriatic acid* has developed, but prices remain unchanged at $25 per ton and 2 to 2¼c. per lb. in carboys. The shortage is ascribed to the fact that there is a better demand now than there was a month ago and supplies from the East have been shut off.

Stocks of *sodium bisulphate* are good and prices remain the same, $5 to $6 a ton being quoted, depending on the size of the order.

Nitric acid is showing signs of activity, inquiries being good. It is quoted at $7 per cwt. for the 36 deg. and $10 per cwt. for the 42 deg. Standard mixed acid remains firm at 1½c. per lb. of sulphuric and 11½c. per lb. of nitric.

There is no change in the price of *zinc chloride*, which registered a 25c. increase some time ago. Producers think this price will remain stable for some time. It is being quoted at $4 per cwt.

There are large stocks of *phenol* on hand, but the St. Louis firm which is disposing of the surplus Government supply is having no trouble keeping the market on it steady. It is being quoted at 12c. per lb. in lots of fifteen tons or more.

General Chemicals

CURRENT WHOLESALE PRICES IN NEW YORK MARKET

		Carlots	Less Carlots
Acetic anhydride	lb.		$0.65 - $0.75
Acetone	lb.	$0.15 - $0.20	.21 - .22
Acid, acetic, 28 per cent	cwt.	3.50 - 3.75	4.00 - 4.50
Acetic, 56 per cent	cwt.	6.50 - 7.50	8.50 - 9.50
Acetic, glacial, 99½ per cent, carboys	cwt.	14.00 - 16.00	16.25 -
Boric, crystals	lb.	.15½ - .16	.16½ - .19
Boric, powder	lb.	.15½ - .16½	.17 - .20
Citric	lb.	.78 - .80	.82 - .84
Hydrochloric (nominal)	cwt.	2.25 - 3.00	3.10 - 4.00
Hydrofluoric, 52 per cent	lb.	.13½ - .14	.14½ - 15½
Lactic, 44 per cent tech	lb.	.10 - .11½	.12 - .16
Lactic, 22 per cent tech	lb.	.04½ - .05½	.06 - .07
Molybdic, C. P.	lb.	4.00 - 4.50	4.50 - 5.00
Muriatic, 20 deg. (see hydrochloric)			
Nitric, 40 deg.	lb.	.06 - .07	.07½ - .08½
Nitric, 42 deg.	lb.	.07½ - .08	.08½ - .09½
Oxalic, crystals	lb.	.45 - .50	.52 - .55
Phosphoric, Ortho, 50 per cent solution	lb.	.18 - .23	.24 - .25
Picric	lb.	.28 - .35	.40 - .50
Pyrogallic, resublimed	lb.	2.30 - 2.55	2.60 - 2.65
Sulphuric, 60 deg., tank cars	ton	12.00 - 16.00	
Sulphuric, 60 deg., drums	ton		
Sulphuric, 66 deg., tank cars	ton	16.00 - 17.00	18.00 - 20.00
Sulphuric, 66 deg., drums	ton	26.00 - 28.00	
Sulphuric, 66 deg., carboys	ton		
Sulphuric, fuming, 20 per cent (oleum) tank cars	ton	27.00 - 30.00	37.00 - 42.00
Sulphuric, fuming, 20 per cent (oleum) drums	ton	28.00 - 30.00	38.00 - 42.00
Sulphuric, fuming, 20 per cent (oleum) carboys	ton	32.00 - 35.00	40.00 -
Tannic, U. S. P.	lb.	1.45 - 1.50	1.55 - 1.65
Tannic (tech.)	lb.	.60 - .70	.80 - .90
Tartaric, crystals	lb.		.74 - .77
Tungstic, per lb. of WO	lb.		1.20 - 1.40
Alcohol, Ethyl (nominal)	gal.	5.50 - 5.75	6.00 - 7.00
Alcohol, Methyl (see methanol)			
Alcohol, denatured, 188 proof (nominal)	gal.		1.12 - 1.15
Alcohol, denatured, 190 proof (nominal)	gal.		1.05 - 1.10
Alum, ammonia lump	lb.	.05 - .05½	.05½ - .06
Alum, potash lump	lb.	.08½ - .08¾	.09 - .09½
Alum, chrome lump	lb.	.17	.18 - .19
Aluminum sulphate, commercial	lb.	.04½ -	
Aluminum sulphate, iron free	lb.	.06	
Aqua ammonia, 26 deg., drums (750 lb.)	lb.	.09½ - .10¾	.11 - .12
Ammonia, anhydrous, cylinders (100-150 lb.)	lb.	.35 - .35½	.36 - .37
Ammonium carbonate, powder	lb.	.16 - .16½	.17 - .18
Ammonium chloride, granular (white salammoniac) (nominal)	lb.	.15½ - .16½	.17 - .18
Ammonium chloride, granular (gray salammoniac)	lb.	.13 - .13½	.13½ - .14½
Ammonium nitrate	lb.	.09 - .10	.11 - .14
Ammonium sulphate	lb.	.07 - .07½	.08½ -
Amylacetate	gal.		5.00 -
Amylacetate tech.	gal.		4.75 - 5.25
Arsenic, oxide, lumps (white arsenic)	lb.	.14 - .16	.16½ - .17
Arsenic, sulphide, powdered (red arsenic)	lb.	.17 - .18	.19 - .23
Barium chloride	ton	130.00-150.00	
Barium dioxide (peroxide)	lb.	.21 - .23	.24 - .25
Barium nitrate	lb.	.10 - .12	.12½ - .13½
Barium sulphate (precip.) (blanc fixe)	lb.	.04½ - .05	.05½ - .06
Bleaching powder (see calcium hypochlorite)			
Blue vitriol (see copper sulphate)			
Borax (see sodium borate)			
Brimstone (see sulphur, roll)			
Bromine	lb.	.70 - .90	1.00 - 1.05
Calcium acetate	cwt	3.50 - 3.55	
Calcium carbide	lb.	.04½ - .04½	.04½ - .05½
Calcium chloride, fused, lump	ton	33.00 - 34.00	35.00 - 45.00
Calcium chloride, granulated	lb.	.02 - .02½	.03 - .03½
Calcium hypochlorite(bleaching powder)	cwt.	7.00 - 7.50	8.00 - 8.50
Calcium peroxide	lb.		1.50 - 1.70
Calcium phosphate, monobasic	lb.		.75 - .80
Calcium sulphate, pure	lb.		.25 - .30
Carbon bisulphide	lb.	.08 - .09	.10 - .11
Carbon tetrachloride, drums	lb.	.14 - .15	.16 - .17
Carbonyl chloride (phosgene)	lb.		
Caustic potash (see potassium hydroxide)			
Caustic soda (see sodium hydroxide)			
Chlorine, gas, liquid-cylinders (100 lb.)	lb.	.09 - .09½	.10 - .10½
Chloroform	lb.	.40 - .43	.44 - .47
Cobalt oxide	lb.		2.09 - 2.05
Copperas (see iron sulphate)			
Copper carbonate, green precipitate	lb.	.27 - .28	.29 - .31
Copper cyanide	lb.		.65 - .70
Copper sulphate, crystals	lb.	.08 - .09	.09 - .09½
Cream of tartar (see potassium bitartrate)			
Epsom salt (see magnesium sulphate)			
Ethyl Acetate Com. 85%	gal.	1.10 - 1.30	1.40 -
Ethy Acetate pure (acetic ether 98% to 100%)			1.75 -
Formaldehyde, 40 per cent (nominal)	lb.	.48 - .50	
Fusel oil, ref.	gal.		5.25 - 6.00
Fusel oil, crude (nominal)	gal.		
Glauber's salt (see sodium sulphate)			
Glycerine, C. P. drums extra	lb.		.26½ - .28½
Iodine, resublimed	lb.	4.30 - 4.35	4.40 - 4.45
Iron oxide, red	lb.		.03 - .20
Iron sulphate (copperas)	cwt.	2.00 - 2.25	2.35 - 2.75
Lead acetate, normal	lb.		.13½ - .16
Lead arsenate (paste)	lb.	.11 - .12	.13 - .17
Lead nitrate, crystals	lb.		.90 - 1.00
Litharge	lb.	.14 - .15	.15½ - .16
Lithium carbonate	lb.		1.50 -
Magnesium carbonate, technical	lb.	.12½ - .13½	.15 - .16
Magnesium sulphate, U. S. P.	100 lb.	3.50 - 3.90	4.00 - 4.50
Magnesium sulphate, commercial	100 lb.		3.50 - 3.60
Methanol, 95%	gal.		3.25 - 3.30
Methanol, pure	gal.		3.50 - 4.50
Nickel salt, double	lb.		.14 - .16
Nickel salt, single	lb.		.13 - .14
Phosgene (see carbonyl chloride)			1.25 - 1.50
Phosphorus, red	lb.	.50 - .55	.60 - .65
Phosphorus, yellow	lb.		.35 - .37
Potassium bichromate	lb.	.33½ - .36	.39 - .40

		Carlots	Less Carlots
Potassium bitartrate (cream of Tartar)	lb.	$0 52 – $0 56	$0.57 – $0.58
Potassium bromide, granular	lb.	–	.70 – .75
Potassium carbonate, U. S. P.	lb.	.50 – .55	.56 – .60
Potassium carbonate, crude	lb.	.20 – .21	.23 – .25
Potassium chlorate, crystals	lb.	.18 – .18½	.19 – .20
Potassium hydroxide (caustic potash)	lb.	.27 – .28	.29 – .33
Potassium iodide	lb.	–	3.35 – 3.60
Potassium nitrate	lb.	.17 – .17½	.19 – .21
Potassium permanganate	lb.	.75 – .80	.85 – .95
Potassium prussiate, red	lb.	.85 – .95	1.00 – 1.05
Potassium prussiate, yellow	lb.	.32 – .36	.35 – .40
Potassium sulphate (powdered)	ton	$240.00 – 255.00	–
Rochelle salts (see sodium potas. tartrate)		–	–
Salammoniac (see ammonium chloride)		–	–
Sal soda (see sodium carbonate)		–	–
Salt cake	ton	–	48.00 – 50.00
Silver cyanide (nominal)	oz.	–	1.25 –
Silver nitrate (nominal)	oz.	–	.60 – .62
Soda ash, light	100 lb.	–	3.20 – 3.50
Soda ash, dense	100 lb.	–	3.55 – 3.65
Sodium acetate	lb.	.10 – .15	.20 – .25
Sodium bicarbonate	100 lb.	2.50 – 2.75	3.00 – 3.50
Sodium bichromate	lb.	.22 – .24	.26 – .27
Sodium bisulphate (nitre cake)	ton	7.00 – 8.00	9.00 – 11.00
Sodium bisulphite Powered, U.S.P.	lb.	.08½ –	.10 – .11
Sodium borate (borax)	lb.	.09 – .10	.11 – .12
Sodium carbonate (sal soda)	100 lb.	2.00 – 2.10	2.15 – 2.25
Sodium chlorate	lb.	.11 – .12	.12½ – .14
Sodium cyanide, 96-98 per cent	lb.	.25 – .30	.32 – .35
Sodium fluoride	lb.	.18 –	.19 – .20
Sodium hydroxide (caustic soda)	100 lb.	5.60 – 5.70	5.75 – 6.00
Sodium hyposulphite	lb.	–	.03 – .04
Sodium molybdate	lb.	2.50 –	3.25½ –
Sodium nitrate	100 lb.	3.00 – 3.25	3.75 – 4.00
Sodium nitrite	lb.	.16 – .18	.19 – .20
Sodium peroxide, powdered	lb.	.32 – .35	.35 – .40
Sodium phosphate, dibasic	lb.	.03½ – .04½	.04½ – .05
Sodium potassium tartrate (Rochelle salts)	lb.	–	.39 – .40
Sodium prussiate, yellow	lb.	.23 – .27	.31 – .32
Sodium silicate, solution (40 deg.)	lb.	.01½ – .01¾	.02 – .02½
Sodium silicate, solution (60 deg.)	lb.	.02½ – .03	.04 – .05
Sodium sulphate, crystals (Glauber's salt)	cwt.	1.60 – 1.70	1.75 – 2.50
Sodium sulphide, crystal, 60–62 per cent (cone)	lb.	09½ – 10	10½ – .11
Sodium sulphite, crystals	lb.	.04 – 0.4½	.04½ – .05
Strontium nitrate, powdered	lb.	.15 – .18½	.19 – .20
Sulphur chloride red	lb.	.08 – .09	.10 – .10½
Sulphur, crude	ton	16.00 – 20.00	–
Sulphur dioxide, liquid, cylinders	lb.	.09 –	.10 – .12
Sulphur (sublimed), flour	100 lb.	–	3.80 – 4.35
Sulphur, roll (brimstone)	100 lb.	–	3.40 – 3.90
Tin bichloride (stannous)	lb.	.42½ – .44	.45 – .46
Tin oxide	lb.	–	.55 – .65
Zinc carbonate, precipitate	lb.	.16 – .18	.19 – .20
Zinc chloride, gran.	lb.	.13 – .13½	.13½ – .17
Zinc cyanide	lb.	.45 – .49	.50 – .60
Zinc dust	lb.	.12 – .13	.13 – .14
Zinc oxide, U. S. P.	lb.	.17 – .25	–
Zinc sulphate	lb.	.03½ – .03¾	.04 – .06

Coal-Tar Products

NOTE—The following prices are for original packages in large quantities:

Alpha-naphthol, crude	lb.	$1.40 —	$1.50
Alpha-naphthol, refined	lb.	1.60 —	1.70
Alpha-naphthylamine	lb.	.50 —	.52
Aniline oil, drums extra	lb.	.30 —	.33
Aniline salts	lb.	.35 —	.40
Anthracene, 80% in drums (100 lb.)	lb.	.90 —	1.00
Benzaldehyde (f.f.c.)	lb.	2.00 —	2.10
Benzidine, base	lb.	1.35 —	1.40
Benzidine sulphate	lb.	1.15 —	1.25
Benzoic acid, U.S.P.	lb.	.85 —	.90
Benzoate of soda, U.S.P.	lb.	.80 —	.90
Benzene, pure, water-white, in drums (100 gal.)	gal.	.38 —	.40½
Benzene, 90% in drums (100 gal.)	gal.	.36½ —	.38½
Benzyl chloride, 95-97%, refined	lb.	.35 —	.40
Benzyl chloride, tech.	lb.	.25 —	.35
Beta-naphthol benzoate (nominal)	lb.	3.50 —	4.00
Beta-naphthol, sublimed (nominal)	lb.	–	–
Beta-naphthol, tech (nominal)	lb.	.80 —	.85
Beta-naphthylamine, sublimed	lb.	2.25 —	2.40
Cresol, U. S. P., in drums (100 lb.)	lb.	.18 —	.19
Ortho-cresol, in drums (100 lb.)	lb.	.23 —	.25
Cresylic acid, 97-99%, straw color, in drums	gal.	1.15 —	1.20
Cresylic acid, 95-97%, dark, in drums	gal.	1.05 —	1.10
Cresylic acid, 50%, first quality, drums	gal.	.65 —	.75
Dichlorbenzene	lb.	.08 —	.10
Diethylaniline	lb.	1.50 —	1.60
Dimethylaniline	lb.	.95 —	1.05
Dinitrobenzene	lb.	.30 —	.37
Dinitroclorbenzene	lb.	.32 —	.35
Dinitronaphthalene	lb.	.45 —	.55
Dinitrophenol	lb.	.40 —	.45
Dinitrotoluene	lb.	–	.40
Dip oil, 25%, tar acids, car lots, in drums	gal.	.38 —	.40
Diphenylamine (nominal)	lb.	.80 —	.85
H-acid (nominal)	lb.	1.90 —	2.05
Meta-phenylenediamine	lb.	1.25 —	1.30
Monochlorbenzene	lb.	.18 —	.20
Monoethylaniline	lb.	2.00 —	2.40
Naphthalene crushed, in bbls. (250 lb.)	lb.	–	–
Naphthalene, flake	lb.	–	.14½
Naphthalene, balls	lb.	.15 —	.17
Naphthionic acid, crude	lb.	.75 —	.85
Nitrobenzene	lb.	.14 —	.19
Nitro-naphthalene	lb.	.40 —	.50
Nitro-toluene	lb.	.18 —	.25
Ortho-amidophenol	lb.	3.25 —	4.25
Ortho-dichlor-benzene	lb.	.15 —	.20
Ortho-nitro-phenol	lb.	.80 —	.85
Ortho-nitro-toluene	lb.	.25 —	.40
Ortho-toluidine	lb.	.30 —	.35
Para-amidophenol, base	lb.	2.50 —	3.00
Para-amidophenol, HCl	lb.	2.50 —	3.00
Para-dichlorbenzene	lb.	.08 —	.12
Paranitroaniline	lb.	1.10 —	1.15
Para-nitrotoluene	lb.	1.35 —	1.50
Para-phenylenediamine	lb.	2.50 —	2.65
Para-toluidine	lb.	2.00 —	2.25
Phthalic anhydride	lb.	.60 —	.70
Phenol, U. S. P., drums (dest.), (240 lb.)	lb.	.12 —	.20
Pyridine	gal.	2.00 —	3.50
Resorcinol, technical	lb.	4.25 —	4.50
Resorcinol, pure	lb.	6.25 —	6.75
Salicylic acid, tech., in bbls. (110 lb.)	lb.	.50 —	.52
Salicylic acid, U. S. P.	lb.	.50 —	.60
Salol	lb.	.90 —	1.00
Solvent naphtha, water-white, in drums, 100 gal.	gal.	.33½ —	.35½
Solvent naphtha, crude, heavy, in drums, 100 gal.	gal.	.25 —	.26
Sulphanilic acid, crude	lb.	.32 —	.35
Tolidine	lb.	1.70 —	2.50
Toluidine, mixed	lb.	.45 —	.55
Toluene, in tank cars	gal.	.35 —	–
Toluene, in drums	gal.	.38½ —	.40½
Xylidines, drums, 100 gal.	lb.	.50 —	.65
Xylene, pure, in drums	gal.	.47½ —	.50½
Xylene, pure, in tank cars	gal.	.45 —	–
Xylene, commercial, in drums, 100 gal.	gal.	.32½ —	.35½
Xylene, commercial, in tank cars	gal.	.30 —	–

Waxes

Prices based on original packages in large quantities.

Beeswax, refined, dark	lb.	$0.36 —	$0.39
Beeswax, refined, light	lb.	.37 —	.38
Beeswax, white pure	lb.	.63 —	.68
Carnauba, No. 1. (nominal)	lb.	.90 —	.95
Carnauba, No. 2, regular (nominal)	lb.	.85 —	.86
Carnauba, No. 3, North Country	lb.	.35 —	.36
Japan	lb.	.17 —	.18
Montan, crude	lb.	.25 —	.26
Paraffine waxes, crude match wax (white) 105-110 m.p.	lb.	.09 —	.09½
Paraffine waxes, crude, scale 124-126 m.p.	lb.	.09½ —	.10
Paraffine waxes, refined, 118-120 m.p.	lb.	.11 —	.11½
Paraffine waxes, refined, 125 m.p	lb.	.12¼ —	–
Paraffine waxes, refined, 128-130 m.p.	lb.	.13 —	.15
Paraffine waxes, refined, 133-135 m.p.	lb.	.16 —	.17
Paraffine waxes, refined, 135-137 m.p.	lb.	.17½ —	.18½
Stearic acid, single pressed	lb.	.20 —	.21
Stearic acid, double pressed	lb.	.22 —	.23
Stearic acid, triple pressed	lb.	.24 —	.25

NOTE—Paraffine waxes very scarce

Flotation Oils

All prices are f.o.b. New York, unless otherwise stated, and are based on carload lots. The oils in 50-gal. bbls., gross weight, 500 lb.

Pine oil, steam dist., sp. gr., 0.930-0.940	gal.	$2.15
Pine oil, pure, dest. dist.	gal.	1.80
Pine tar oil, ref., sp. gr. 1.025-1.035	gal.	.48
Pine tar oil, crude, sp. gr. 1.025-1.035 tank cars f.o.b. Jacksonville, Fla.	gal.	.35
Pine tar oil, double ref., sp. gr. 0.965-0.990	gal.	.85
Pine tar, ref., thin, sp. gr., 1.080-1.960	gal.	.36
Turpentine, crude, sp. gr., 0.900-0.970	gal.	1.75
Hardwood oil, f.o.b. Mich., sp. gr., 0.960-0.990	gal.	.35
Pinewood creosote, ref.	gal.	.52

Naval Stores

The following prices are f.o.b., New York, for carload lots.

Rosin B-D, bbl.	280 lb.	$14.60 —	–
Rosin E-I	280 lb.	14.50 —	–
Rosin K-N	280 lb.	14.50 —	–
Rosin W. G.-W. W.	280 lb.	14.50 —	–
Wood rosin, bbl.	280 lb.	15.00 —	–
Spirits of turpentine	gal.	1.49 —	–
Wood turpentine, steam dist.	gal.	–	–
Wood turpentine, dest. dist.	gal.	–	–
Pine tar pitch, bbl.	200 lb.	–	8.50
Tar, kiln burned, bbl. (500 lb.)	bbl.	14.50 —	15.00
Retort tar, bbl.	500 lb.	15.00 —	15.50
Rosin oil, first run	gal.	.72 —	–
Rosin oil, second run	gal.	.75 —	–
Rosin oil, third run	gal.	.92 —	–

Solvents

73-76 deg., steel bbls. (85 lb.)	gal.	$0.40
70-72 deg., steel bbls. (85 lb.)	gal.	.38
68-70 deg., steel bbls. (85 lb.)	gal.	.37
V. M. and P. naphtha, steel bbls. (85 lb.)	gal.	.29

Crude Rubber

Para—Upriver fine	lb.	$0.29 —	$0.31
Upriver coarse	lb.	.19 —	.20
Upriver caucho ball	lb.	.20 —	.22
Plantation—First latex crepe	lb.	.30 —	–
Ribbed smoked sheets	lb.	.28 —	–
Brown crepe, thin, clean	lb.	.26 —	–
Amber crepe No. 1	lb.	.28 —	–

Oils

VEGETABLE

The following prices are f.o.b., New York for carload lots.

Castor oil, No. 3, in bbls.	lb.	$0.16½ —	$0.18
Castor oil, AA, in bbls.	lb.	.19 —	–
China wood oil, in bbls. (f.o.b. Pac. coast)	lb.	.15½ —	.16
Cocoanut oil, Ceylon grade, in bbls.	lb.	.15 —	.16
Cocoanut oil, Cochin grade, in bbls (nominal)	lb.	.16 —	.17½
Corn oil, crude, in bbls	lb.	.11½ —	.13
Cottonseed oil, crude (f.o.b. mill)	lb.	.10 —	.11
Cottonseed oil, summer yellow	lb.	.14 —	.15
Cotconseed oil, winter yellow	lb.	.17½ —	.18½
Linsed oil, raw, car lots (domestic)	gal.	1.25 —	....
Linseed oil, raw, tank cars (domestic)	gal.	1.22 —	....
Linseed oil, boiled, car lots (domestic)	gal.	1.33 —	....

Olive oil, commercial	gal.	3.00 —	3.50
Palm, Lagos	lb.	.10½ —	.....
Palm, bright red	lb.	—	.....
Palm, Niger	lb.	.10 —	.10½
Peanut oil, crude, tank cars (f.o.b. mill)	lb.	.10½ —	.12½
Peanut oil, refined, in bbls	lb.	.17 —	.18
Rapeseed oil, refined in bbls	gal.	1.40 —	1.50
Rapeseed oil, blown, in bbls	gal.	1.60 —	1.70
Soya bean oil (Manchurian), in bbls. N. Y.	lb.	.14 —	.14½
Soya bean oil, tank cars, f.o.b., Pacific coast	lb.	.09½ —	.11
FISH			
Winter pressed Menhaden	gal.	$0.90 —	$1.05
Yellow bleached Menhaden	gal.	0.95 —	1.05
White bleached Menhaden	gal.	1.00 —	1.25
Blown Menhaden	gal.	1.00 —	1.20

Miscellaneous Materials

All f. o. b. New York Unless Otherwise Stated

Barytes, ground, white, f.o.b. Kings Creek, S. C.	net ton	$22.00 —	$25.00
Barytes, ground, off color, f.o.b. Kings Creek	net ton	18.00 —	20.00
Barytes, crude, 88%@94% ba., Kings Creek	net ton	8.00 —	10.00
Barytes, ground, white, f.o.b. Cartersville, Ga.	net ton	23.00 —	25.00
Barytes, ground, off-color, f.o.b. Cartersville	net ton	16.00 —	19.00
Barytes, crude, 88%@94% ba., Cartersville	net ton	12.00 —	.....
Barytes, floated, f.o.b. St. Louis	net ton	26.50 —	28.00
Barytes, crude, min. 98% ba., Missouri	net ton	11.00 —	11.25
Blanc fixe, dry	lb.	.05½ —	.06
Blanc fixe, pulp	net ton	60.00 —	80.00½
Casein	lb.	.15 —	.18
Chalk, domestic, extra light	lb.	.05 —	.06
Chalk, domestic, light	lb.	.04½ —	.05½
Chalk, domestic, heavy	lb.	.04 —	.05
Chalk, English, extra light	lb.	.05 —	.07
Chalk, English, light	lb.	.05 —	.06
Chalk, English, dense	lb.	.04½ —	.05
China clay, (Kaolin) crude, f.o.b. mines, Georgia	net ton	9.00 —	12.00
China clay (Kaolin) washed, f.o.b. Georgia	net ton	12.00 —	15.00
China clay (Kaolin) powdered, f.o.b. Georgia	net ton	18.00 —	22.00
China clay (Kaolin) crude f.o.b. Virginia points	net ton	8.00 —	12.00
China clay (Kaolin) ground, f.o.b. Virginia points	net ton	15.00 —	40.00
China clay (Kaolin), imported, lump	net ton	25.00 —	35.00
China clay (Kaolin), imported, powdered	net ton	30.00 —	60.00
Feldspar, crude, f.o.b. Maryland and North Carolina points	gross ton	7.50 —	8.00
Feldspar, crude, f.o.b. Maine	net ton	7.50 —	10.00
Feldspar, ground, f.o.b. Maine	net ton	21.00 —	23.00
Feldspar, ground, f.o.b. North Carolina	net ton	17.00 —	21.00
Feldspar, ground, f.o.b. N. Y. State	net ton	17.00 —	21.00
Feldspar, ground, f.o.b. Baltimore	net ton	30.00 —	.....
Fuller's earth, granular, f.o.b. Fla.	net ton	25.00 —	.....
Fuller's earth, powdered, f.o.b. Fla.	net ton	18.00 —	.....
Fuller's earth, imported, powdered	net ton	35.00 —	40.00
Graphite (dust polish grade 30%) Ashland, Ala.	lb.	..... —	.01
Graphite (dust facing grade 50%) Ashland, Ala.	lb.	..... —	.02
Graphite, crucible, 80% carbon Ashland, Ala.	lb.	..... —	.05
Graphite, crucible, 90% carbon Ashland, Ala.	lb.	..... —	.10
Graphite, crucible, 85% carbon	lb.	..... —	.08
Graphite, crucible, 88% carbon	lb.	..... —	.09½
Graphite, crucible, 90% carbon	lb.	..... —	.10½
Pumice stone, imported, lump	lb.	.04 —	.50
Pumice stone, domestic, lump	lb.	.06 —	.....
Pumice stone, ground	lb.	.04 —	.07
Quartz (acid tower) fist to head, f.o.b. Baltimore	net ton	..... —	10.00
Quartz (acid tower) 1½@2 in., f.o.b. Baltimore	net ton	..... —	14.00
Quartz (acid tower) rice, f.o.b. Baltimore	net ton	..... —	17.00
Quartz, lump, f.o.b. North Carolina	net ton	5.00 —	7.50
Shellac, orange fine	lb.	1.35 —	1.40
Shellac, orange superfine	lb.	1.40 —	1.45
Shellac, A. C. garnet	lb.	1.10 —	1.15
Shellac, T. N.	lb.	1.15 —	1.20
Soapstone	ton	15.00 —	25.00
Talc, paper-making grades, f.o.b. Vermont	ton	10.00 —	20.00
Talc, roofing grades, f.o.b. Vermont	ton	9.00 —	15.00
Talc, rubber grades, f.o.b. Ve mont	ton	10.00 —	15.00
Talc, powdered, Southern, f.o.b. cars	ton	12.00 —	15.00
Talc, imported	ton	60.00 —	70.00
Talc, California Talcum Powder grade	ton	20.00 —	35.00

Refractories

Chrome brick, f.o.b. Chester, Pa., carlots	net ton	100- 110
Chrome brick, 9-in. strs. and sizes, f.o.b. Baltimore	net ton	100- 105
Fire clay brick, 1st quality, 9-in. shapes, f.o.b. Pennsylvania, Ohio and Kentucky works	1,000	55- 60
Fire clay brick, 1st quality, f.o.b. St. Louis	1,000	45- ...
Fire clay brick, 1st quality, f.o.b. New Jersey	1,000	75- ...
Fire clay brick, 2d quality, 9-in. shapes f.o.b. Pennsylvania, Ohio and Kentucky works	1,000	50- 55
Magnesite brick, 9 in. straights, f.o.b. Baltimore	net ton	110 120
Magnesite brick, 9-in. sizes and shapes larger than 9-in.		Regular extras
Magnesite brick, f.o.b. Chester	net ton	90- 100
Silica brick, 9-in. and 9-in. sizes, Chicago district	1,000	65- 70
Silica brick, f.o.b. Birmingham	1,000	56- 61
Silica brick, f.o.b. Mt. Union, Pa.	1,000	65- ...

Ferro-Alloys

All f.o.b. Works

Ferro-carbon-titanium, 15-18%, f.o.b. Niagara Falls, N. Y.	net ton	$200.00 —	$250.000
Ferro-chrome, per lb. of Cr. contained, 6-8% carbon, carlots	lb.	.18 —	.19
Ferro-chrome, per lb. of Cr. contained, 4-6% carbon, carlots	lb.	.20 —	.21
Ferro-manganese, 76-80% Mn, domestic	gross ton	195.00 —	200.00
Ferro-manganese, 76-80% Mn, English	gross ton	170.00 —	175.00
Spiegeleisen, 18-22% Mn	gross ton	80.00 —	85.00
Ferro-molybdenum, 50-60% Mo, per lb. of Mo.	lb.	2.25 —	2.75
Ferro-silicon, 10-15%	gross ton	60.00 —	65.00
Ferro-silicon, 50%	gross ton	80.00 —	90.00
Ferro-silicon, 75%	gross ton	150.00 —	160.00
Ferro-tungsten, 70-80%, per lb. of contained W.	lb.	1.10 —	1.15
Ferro-uranium, 35-50% of U, per lb. of U content	lb.	7.00 —	.....
Ferro-vanadium, 30-40% per lb. of contained V.	lb.	6.50 —	7.75

Ores and Semi-finished Products

All f.o.b. Mines, Unless Otherwise Stated

Bauxite, 52% Al. content, less than 2% Fe_2O_3, up to 20% silica, not more than H4% moisture	gross ton	$10.00 —	$11.00
Chrome ore, Calif. concentrates, 50% min. Cr_2O_3	unit	.60	.65
Chrome ore, 50%, max., Cr_2O_3, f.o.b. Atlantic Seaboard	unit	.65 —	.70
*Coke, foundry, f.o.b. ovens	net ton	18.00 —	20.00
*Coke, furnace, f.o.b. ovens	net ton	17.00 —	18.00
*Coke, petroleum, refinery, Atlantic Seaboard	net ton	24.00	
Fluor spar, lump, f.o.b. Tonuco, New Mexico	net ton	17.50 —	.....
Fluor spar, standard, domestic washed gravel Kentucky and Illinois mines	net ton	25.00 —	27.50
Ilmenite, 52% TiO_2, per lb. ore	lb.	.01½ —	85.02
Manganese Ore, 50% Mn, c.i.f. Atlantic seaport	unit	.65 —	.75
Manganese ore, chemical (MnO_2)	gross ton	75.00 —	90.00
Molybdenite, 85% MoS_2, per lb. of MoS_2, N. Y.	lb.	.70 —	.75
Monazite, per unit of ThO_2	unit	42.00 —	.....
Pyrites, Spanish, fines, c.i.f., Atlantic seaport	unit	.12 —	.....
Pyrites, Spanish, furnace size, c.i.f., Atlantic seaport	unit	.16½ —	.....
Pyrites, Spanish, run of mines, ci.f., Atlantic seaport	unit	.12 —	.14
Pyrites, domestic, fines	unit	.12 —	.14
Rutile, 95% TiO_2 per lb. ore	lb.	.15 —	.....
Tungsten, Scheelite, 60% WO_3 and over, per unit of WO_3	unit	7.00 —	.....
Tungsten, Wolframite, 60% WO_3 and over, per unit of WO_3, N. Y. C.	unit	5.00 —	.....
Uranium Ore (Carnotite) per lb. of U_3O_8	lb.	2.75 —	3.00
Uranium oxide, 96% per lb. contained U_3O_8	lb.	2.75 —	3.00
Vanadium pentoxide, 99%	lb.	12.00 —	14.00
Vanadium Ore, per lb. of V_2O_5 contained	lb.	1.25 —	.....
Zircon, washed, iron free	lb.	.10 —	.....

*Nominal

Non-Ferrous Metals

New York Markets

	Cents per Lb.
Copper, electrolytic	18.50
Aluminum, 98 to 99 per cent	34.90
Antimony, wholesale lots, Chinese and Japanese	7.00
Nickel, ordinary (Ingot)	43.00
Nickel, electrolytic	45.00
Tin, 5-ton lots	45.50
Lead, New York, spot	8.40
Lead, E. St. Louis, spot	8.20
Zinc, spot, New York	8.00
Zinc, spot, E. St. Louis	7.70@8.05

OTHER METALS

Silver (Commercial)	oz.	$0.99½
Cadmium	lb.	1.40@1.50
Bismuth (500 lb. lots)	lb.	2.70
Cobalt	lb.	4.00@6.00
Magnesium (f.o.b. Niagara Falls)	lb.	1.75
Platinum	oz.	115.00
Iridium	oz.	350.00
Palladium	oz.	100.00@110.00
Mercury	75 lb.	83.00

FINISHED METAL PRODUCTS

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	33.50
Copper bottoms	38.00
Copper rods	38.00@40.00
High brass wire and sheets	30.25
High brass rods	27.00
Low brass wire and sheets	28.50
Low brass rods	29.00
Brazed brass tubing	38.25
Brazed bronze tubing	41.75
Seamless copper tubing	34.00
Seamless high brass tubing	33.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy and crucible	15.00	17.00	14.00	15.00
Copper, heavy and wire	14.00	16.00	13.50	14.50
Copper, light and bottoms	12.50	14.00	12.00	13.00
Lead, heavy	7.00	4.75	7.00	7.00
Lead, tea	5.00	3.75	4.00	6.00
Brass, heavy	9.50	10.50	10.00	14.50
Brass, light	7.00	7.50	7.00	8.00
No. 1 yellow brass turnings	8.50	10.00	7.50	8.00
Zinc	5.00	5.00	4.50	5.50

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$4.58	$3.97	$3.47	$5.00	$3.37	$3.97	$3.47
Soft steel bars	4.73	4.12	3.37	4.50	3.27	3.87	3.37
Soft steel bar shapes	4.73	4.12	3.37	....	3.27	3.87	3.37
Soft steel bands	6.43	5.32	4.07	6.25	....	....	....
Plates, ¼ to 1 in. thick	4.78	4.17	3.67	4.50	3.57	4.17	3.67

Industrial

Financial, Construction and Manufacturers' News

Construction and Operation

Colorado

DENVER — The Eaton Metal Products Co., 1843 Mazee St., is having plans prepared for the construction of a 1 story steel products manufacturing plant on York St. near the Union Pacific shops. Estimated cost, $175,000.

DENVER—The Federal Glass Co., 1717 Champa St., is having plans prepared for the construction of a glass factory. Estimated cost, $250,000. J. W. Busard, c/o Sylvester & Co., 1717 Champa St., engr. Noted Sept. 1.

DENVER — The Great Valleys Sugar Corp., 800 Central Savings Bank Bldg., is having preliminary plans prepared for the construction of 3 complete sugar factories. Estimated cost, $3,000,000. A. F. Lyster, engr.

LA SALLE—The Industrial Sugar Co., Barclay Block, Denver, has awarded the contract for the construction of a sugar factory, consisting of several buildings, to Baum & Baum, Salt Lake City, Utah. Estimated cost, $1,800,000.

Connecticut

ANSONIA — The Amer. Brass Co., 58 Liberty St., plans to build several large additions to its plant on Bridge St.

Illinois

DE KALB—Rev. J. A. Solon plans to build a 3-story, 40x179-ft. hospital. A chemical laboratory will be installed in same. Estimated cost, $150,000. Arthur Foster, 1555 North Clark St., archt.

Indiana

TERRE HAUTE — The Hoosier Rolling Mills Co. will build a 1-story, 100x600-ft. factory. Estimated cost, $100,000. Work will be done by day labor.

Iowa

MALLARD — The City Clerk will soon receive bids for the construction of a sewage disposal plant, sand filter and sludge beds. Estimated cost, $50,000. E. T. Archer & Co., New England Bldg., Kansas City, Mo., engrs.

NEW MARKET—The City Clerk will soon award the contract for the installation of a septic tank and sludge bed. Estimated cost, $64,000. E. T. Archer & Co., New England Bldg., Kansas City, Mo., engrs.

Maine

HOWLAND—The Howland Pulp & Paper Co., 301 Congress St., has awarded the contract for the construction of a 38x72-ft. addition to paper machine building and a 75x103-ft. addition to sulphate pulp mill to Green & Wilson, Waterville. Estimated cost, $120,000.

Maryland

BALTIMORE—The Baltimore Malleable Iron & Steel Castings Co., Charles and Wells Sts., plans to install additional blast furnaces and other equipment. Estimated cost, $100,000.

CANTON (Baltimore P. O.)—The Standard Oil Co., Pratt and South Sts., plans to build an oil refinery here. Estimated cost, $7,000,000. E. A. Holbein, supt.

SPARROWS POINT — J. E. Sperry, archt., 409 Calvert Bldg., Baltimore, will soon award the contract for the construction of a 3-story hospital for the Bethlehem Steel Corp. A laboratory including equipment will be installed in same. Estimated cost, $150,000.

Massachusetts

PALMER—The Palmer Fdry. & Machine Co., 27 Foundry St., has awarded the contract for the construction of a 1-story foundry to the Flynt Bldg. & Constr. Co., 356 Main St. Estimated cost, $20,000.

RUSSELL — The Chapin & Gould Paper Co., 317 Main St., Springfield, has awarded the contract for the construction of a 4-story paper factory to F. T. Ley & Co., Inc., 499 Main St., Springfield. Estimated cost, $100,000.

WORCESTER—Holy Cross College, College St., plans to build 5 buildings including a science hall, etc. Estimated cost, $1,000,000.

Michigan

DELRAY (Detroit P. O.) — The Inland Delray Salt Co. will soon award the contract for the construction of a 2-story, 140x170-ft. factory. Estimated cost, $60,000. Stahl & Kinsey, 435 Woodward Ave., Detroit, archts.

MONROE—Reed M. Dunbar, archt., will soon award the contract for the construction of a 1-story, 90x210-ft. foundry on East 1st St. for the Monroe Auto Equipment Co., East 1st St. Estimated cost, $100,000. Noted Sept. 15.

New Hampshire

GROVETON—The Groveton Paper Co., Inc., has awarded the contract for the construction of a 2-story, 55x200-ft. paper factory to Swan & Son, St. Johnsbury, Vt. Estimated cost, $100,000.

New Jersey

BRIDGETON—The Illinois Glass Co. has awarded the contract for the construction of a glass factory including a 3-story, 330x700-ft. main plant and two 50x150-ft. units, etc., to the Keeley Bros. Constr. Co., 507 Federal St., Camden. Estimated cost, $3,000,000. Noted Sept. 15.

HIGHTSTOWN — The Borough has awarded the contract for filtration plant equipment including 2 horizontal steel pressure filters to the New York Continental Jewel Filtration Co., Flatiron Bldg., New York City. Estimated cost, $8,000.

NEWARK — The George LaComte Co. plans to build a 75x140-ft. factory for the manufacture of concrete blocks on Victoria St. Estimated cost, $25,000. Fred Noble, engr.

New York

RIKERS ISLAND — The Dept. of Correction received bids for the installation of sterilizing and disinfection machines at the farm here from Kny-Scheerer Co., 56 West 23rd St., New York City, $1,770; Cromwell Dean Co., $1,779.

Ohio

ALLIANCE—The Alliance Brick Co. is building a plant and is in the market for brick-making machinery.

CANTON—The United Eng. & Fdry. Co., 13th St., N.E., has awarded the contract for the construction of a 1-story, 136x240-ft. factory on Grace Ave., N.E., and 13th St., N.E., to R. G. Whitter, 1539 Howard Court, N.W. Estimated cost, $75,000.

LONDON — The Williams Mfg. Co. has awarded the contract for the construction of a 1-story, 50x180-ft. factory to W. H. Robbins, Springfield. Estimated cost, $45,000.

TOLEDO — The Acklin Stamping Co., Dorr St., has purchased a site on Nebraska Ave. near the Lake Shore Crossing and plans to build a large factory on same. Annealing furnaces, nickel plating and galvanizing plants, electric welding and tool departments will be installed in same. D. T. Anderson, supt.

Pennsylvania

AVONDALE — The Consolidated Bd. of New Gordon and Loudin Grove Townships in West Grove and Avondale Boroughs, Chester Co., plans to build a 2-story high school here. A chemical laboratory will be installed in same. Estimated cost, $100,000. Ritter & Shay, North Amer. Bldg., Philadelphia, archts.

Texas

WICHITA FALLS — The State Bd. of Control, Austin, will receive bids until Oct. 4 for the construction of a sewage disposal plant, etc., at the Northwest Texas Insane Asylum here.

Vermont

NORTHFIELD—H. Pelaggi & Co. will build a 1-story, 60x425-ft. plant addition. Estimated cost, $50,000. Work will be done by day labor.

Wisconsin

MERTON — The Merton Dairy Products Co. has awarded the contract for the construction of a 1-story, 30x45-ft. addition to its creamery to Reisinger & Co., 425 East Water St., Milwaukee. A chemical laboratory will be installed in same. Estimated cost, $18,000. Noted July 28.

Quebec

MONTREAL—The L'air Liquide Society, Maisoneuve, plans to build extensions to its welding and cutting plants.

MONTREAL—The Natl. Drug & Chemical Co., 34 St. Paul St., has awarded the contract for the construction of a factory to Church, Ross & Co., 10 Cathcart St. Estimated cost, $75,000. Noted June 23.

Ontario

AGATE — S. Bromley, Pembroke, representing owners, plans to build a pulp and paper mill here. Estimated cost, $500,000.

PETROLEA—E. A. Stokes plans to build a plant for the manufacture of nitroglycerine and is in the market for machinery and equipment for same. Estimated cost, $100,000.

Manufacturers' Catalogs

THE READING IRON PIPE CO., Reading, Pa., has issued Bull. No. 1, entitled "Reading Wrought Iron Pipe." It is a very instructive booklet, and gives in thirty-two pages very interesting descriptions of the origin and development of the wrought iron industry, the puddling process, the manufacture of skelp, why wrought iron is better for making welded pipe than steel, Reading iron pipes in oil country service, building service, refrigerating service, coal mine service, and charcoal iron boiler tubes for locomotive, marine and stationary boilers, together with appropriate illustrations.

THE JEFFREY MANUFACTURING CO., Columbus, O., has issued two new catalogs. No. 312 is entitled "Jeffrey Storage Battery Locomotives for Mines." Particular attention is called in this catalog to the Jeffrey pivoted battery box, which makes motors accessible for inspection and oiling without having to remove the battery box, also allows removing and replacing of the pinions on the armature shaft without having to run the locomotive under a crane or over a pit. It fully illustrates and describes other important features of Jeffrey storage battery locomotives for mining service, including motor equipment, new style journal box for inside wheel type locomotive, etc., and also contains illustrative photographs of electric gathering locomotives of the Standard cable reel and crab reel types. Catalog No. 263 is entitled "Jeffrey Mine Locomotives." This catalog fully illustrates and describes the electrical and mechanical features of this company's complete line of mine locomotives, including the "Armorplate" type of main haulage locomotive, and electric gathering locomotives of the cable reel, crab reel, combination cable and crab reel, and electric storage battery types. Both of these catalogs are interesting and contain many illustrations.

VACUUM OIL CO., New York, has published a 32-page booklet on Bearings and Their Lubrication. The construction, types and materials used in bearings are briefly outlined. Oiling systems, distribution and lubrication are discussed. Oils and greases are described relative to their application.

THE PERMUTIT CO., New York, announces the publication of Bull. No. 101, which covers the various products manufactured by the company. This attractive 32-page catalog contains a brief discussion of water rectification or conditioning problems, and the solution by the complete line of apparatus manufactured by the Permutit Co., such as softeners, filters, iron and manganese removal equipment, etc., although it is not an attempt to cover the vast field, but serves principally to indicate the problems which have been met and solved by its technical staff. Many interesting illustrations are given, together with descriptive matter.

Coming Meetings and Events

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE will hold its 1920 meeting Dec. 27, 1920, to Jan. 1, 1921, at Chicago, Ill.

AMERICAN CERAMIC SOCIETY will hold its annual meeting the week of Feb. 21, 1921, at Columbus, Ohio, with headquarters at the Deschler Hotel.

AMERICAN ELECTROCHEMICAL SOCIETY will hold its fall meeting in the Hotel Statler, Cleveland, Ohio, Sept. 30, Oct. 1 and 2.

AMERICAN ENGINEERING COUNCIL of the Federated American Engineering Societies will hold a meeting Nov. 18 and 19, 1920, in Washington, D. C. Headquarters will be at the New Willard Hotel.

AMERICAN FOUNDRYMEN'S ASSOCIATION will hold its 1920 convention and exhibit at Columbus, Ohio, the week of Oct. 4.

A.I.M.E. PETROLEUM AND GAS MEETING is being held in St. Louis, Mo., Sept. 21 and 22, in conjunction with the American Society for Testing Materials and the Petroleum Fuel Section of the A.S.M.E. It is expected that this meeting will crystallize into a petroleum and gas section of the A.I.M.E.

AMERICAN MINING CONGRESS will hold its next convention in Denver Nov. 15.

AMERICAN PHYSICAL SOCIETY will hold a meeting Nov. 27 at the Case School of Applied Science, Cleveland, and the annual meeting, beginning Dec. 28, at Chicago, the latter being the occasion of the special quadrennial meeting of the American Association for the Advancement of Science and the Affiliated Societies.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS' 1920 annual meeting will be held in the Engineering Societies' Building, from Dec. 7 to 10 inclusive.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS is holding its 14th annual convention at the Hotel Pennsylvania, New York City, Sept. 20 to 24.

CANADIAN INSTITUTE OF MINING AND METALLURGY will hold its second annual Western meeting in Winnipeg, Man., on Oct. 25, 26 and 27. Headquarters will be at the Hotel Fort Garry.

THE CHEMICAL WARFARE POST of the American Legion will hold its next meeting Sept. 22, at 8 p.m., in the conference room of the Grand Central Palace, New York City.

ELECTRIC FURNACE ASSOCIATION will hold a meeting Oct. 6, at Columbus, Ohio, the subject of which will be "Refractories."

ENGINEERING COUNCIL will hold its next meeting in Chicago Thursday, Oct. 21.

INSTITUTE OF METALS DIVISION OF THE A.I.M.E. will hold its usual joint meeting with the American Foundrymen's Association at Columbus, Ohio, during the week beginning Oct. 4.

NATIONAL ASSOCIATION OF PURCHASING AGENTS will hold its annual convention at the Congress Hotel, Chicago, Ill., Oct. 11, 12 and 13.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES (SIXTH) is being held in the Grand Central Palace, New York City, Sept. 20 to 25.

THE RUBBER SECTION of the National Safety Council will consider safety problems of especial interest to the rubber industry at a section conference to be held Sept. 29 to Oct. 1, in connection with the national session of the Council to be held in Chicago.

SOCIETY OF INDUSTRIAL ENGINEERS will hold its fall national convention at Carnegie Music Hall, Pittsburgh, Pa., Nov. 10, 11 and 12.

Industrial Notes

UEHLING INSTRUMENT CO., New York City, manufacturer of fuel economy equipment, announces that it is now being represented in the New England States by the Smith Engineering & Supply Co., 89 State St., Boston, Mass., manufacturers' agent and engineer, specializing in power plant equipment. S. W. Smith, president of the latter company, was until very recently associated with the Uehling Instrument Co. with headquarters in the New York office.

C. M. TEATS, formerly secretary of the Oklahoma Brick Manufacturers Association, has moved to Memphis, Tenn., where he will be local manager for the Reliance Brick Co., manufacturer of building and enameled brick, hollow tile, etc.

THE INDUSTRIAL DEVELOPMENT COMMITTEE of the Oklahoma Chamber of Commerce is planning a survey of the industries of that territory. The work is divided into various sections, such as banking, labor conditions, transportation, agriculture, oil, tar, living conditions, business utilities, etc. Increased production of mining and manufacturing has made the inauguration of a comprehensive study necessary.

THE PORTER POTTERY CO., INC., of Clinton Ky., has established a branch office in the McCall Bldg., at Memphis, Tenn.

THE SAMSON MOTOR TRUCK CO., of Janesville, Wis., a division of the General Motors Corp., has established a branch at 228 Monroe Ave., Memphis, Tenn.

A. LUSSKIN & CO., New York City, announces that I. Miller of its staff sailed on the Adriatic, Aug. 14, for an extended trip through Europe, in connection with the purchase and sale of chemicals, colors, oils and waxes.

THE VOOLRATH CO., of Sheboygan, Wis., manufacturer of enameled ware, has secured a building for the installation of a plant at 821 West Lake St., Chicago, Ill.

THE JEWELL POLAR CO., manufacturer of water stills, has purchased the 2-story factory at 565 West Van Buren St., Chicago.

QUIGLEY FURNACE SPECIALTIES CO., New York City, announces that the furnaces for the new sheet mill of Follansbee Bros. Co., Toronto, Ohio, will be fired with powdered coal. For transporting the pulverized fuel from the milling plant to the furnace bins, the Quigley air transport system has been adopted. A standard blowing unit of five tons capacity consisting of pulverized fuel bin, blow tank and scales, which is capable of transporting ten tons of pulverized coal per hour, will be installed. The total distance for transporting fuel is approximately 1,700 ft. This blowing equipment is being furnished by the Quigley Furnace Specialties Co.

EASTON CAR & CONSTRUCTION CO. announces the opening of a new office in the Peoples Gas Bldg., Chicago, to take care of the increasing business in the West and Middle West districts.

THE METAL & THERMIT CORP., New York City, has made arrangements to secure life insurance for all its employees who have served the company for at least six months. The amount of protection is graded according to the length of service, ranging from $700 for six months' service up to $3,000 for twenty years' service. The company bears the entire expense of this insurance, which is in addition to any compensation to which its employees might be entitled under the present state compensation laws. The insurance will be paid in monthly payments during the first year after death.

THE WHITMAN & BARNES MFG. CO., operator of a large forging plant in Chicago, has merged its plant with J. H. Williams & Co., manufacturer of drop forgings and tools, with plants at Brooklyn and Buffalo, N. Y.

WILSON WELDER & METALS CO., whose general offices were formerly at 2 Rector St., is now located at 253 36th St., Bush Terminal, Brooklyn, N. Y., and the Wilson Welding Repair Co. has moved its offices from 2 Rector St. to 263 First St., Jersey City, N. J.

THE FORD ROOFING PRODUCTS CO., now in St. Louis, plans to move its executive offices to Chicago and within the year to build a $1,000,000 plant there. The new offices will be located in the Conway Bldg. J. W. Ford is president.

BEER, SONDHEIMER & CO., INC., New York City, has legally changed its name to the International Minerals & Metals Corp. The active business management of the corporation and its relationship to its affiliated and subsidiary companies has in no way been affected and will continue as heretofore.

PROF. CHARLES H. LAWALL, dean of the Philadelphia College of Pharmacy and well-known analytical and consulting chemist, has removed his laboratory and office from 30 South Tenth Street to 636 Franklin Sq., Philadelphia.

THE CUTLER-HAMMER MFG. CO. announces the following recent installations of Thomas meters: At the Readsboro (Vt.) plant of the International Nitrogen Co., a 50,000 cu.ft. per hr. meter, measuring carbon monoxide gas given off in the process of carbide manufacture; a 300,000 cu.ft. per hr. station meter for measuring water gas in Plymouth, England, at the Plymouth and Stonehouse Gas Light & Coke Co.; another English installation is that of a 400,000 cu.ft. per hr. meter, measuring water gas; another foreign order has been received from the Brokenhill Proprietary Co., New Castle, Australia, for five 500,000 cu.ft. per hr. meters for measuring coke-oven gas. At Sparrows Point, Md., three new meters are being installed: one for the Consolidated Gas, Electric Light & Power Co., for measuring coke-oven gas pumped into the distribution system and another of 200,000 cu.ft. per hr. meter, measuring surplus coke-oven gas purchased from the Consolidated Gas & Electric Light Co., the gas at this point being under 10 to 15 lb. gage pressure; while a third at this same location is of 300,000 cu.ft. per hr. capacity for measuring surplus coke-oven gas. The Consolidated Gas Co. of New York has installed in the Westchester Light Co. plant a 500,000 cu.ft. per hr. station meter, measuring water gas. Two 1,250,000 cu.ft. per hr. meters and two 800,000 cu.ft. per hr. meters purchased by the Koppers Co. are for installation at the Chicago By-Product Coke Co., the first two to measure water gas sold to the Peoples Gas Light Co., and the smaller meters to measure surplus coke-oven gas sold to the Peoples Gas Light Co.

C. A. BREED, metallurgist, and E. M. HEUMANN, chemical engineer, have recently joined the staff of the new industrial research laboratory established in Cleveland, Ohio, by Daniel M. Luehrs.

THE CELITE PRODUCTS CO. announces that P. A. Boeck, manager of distribution at the New York office, is now located at the company's Los Angeles office, where he will supervise the production work. Thomas G. Lee, Jr., will act as general sales manager, with headquarters in New York.

THE LAKEWOOD ENGINEERING CO., Cleveland, O., announces that Robert M. Gates has been appointed managing engineer in charge of the Philadelphia district of the company, with offices at 1034 Widener Bldg., Philadelphia.

THE SEMET-SOLVAY CO. has appointed J. L. Landt superintendent of the Buffalo plant, manufacturing coke and byproducts.

THE CELITE PRODUCTS CO. announces that it is now represented in the Buffalo district by the Empire Co., 334 Ellicott Square, Buffalo, N. Y.

GUSTAVE DROBEGG, consulting chemist, specializing in intermediates for dyes, pharmaceuticals, essential oils and synthetic aromatics, announces his removal from 38 Park Row to 5 Beekman St., New York City.

THE BETHLEHEM FOUNDRY & MACHINE CORP. has purchased the business of Stevens Bros., 149 Broadway, New York. All of the personnel and staff of Stevens Bros. are retained and the Bethlehem Foundry & Machine Corp. will conduct a business as engineer and contractor to the chemical industry at 149 Broadway, New York City.

THE CRESCENT PRODUCTS CO. of Hartford, Conn., was recently incorporated to deal in chemical formulas, etc. The organizers of the company are J. L. Porcheron, H. G. Wilson and W. E. Chapin, attorney of 874 Main St., Hartford, Conn. The capital of the new company is $10,000.

THE MONO CORPORATION OF AMERICA announces the removal of its main office from Buffalo to 25 West Broadway, New York City, where its complete line of automatic continuously recording gas analyzing instruments for CO_2, CO, O_2, SO_2, H_2, N_2, CH_4, etc., will be displayed. F. D. Harger, vice-president and general manager, D. W. Reid and others will offer chemical service in matters relating to the automatic, continuous recording of gas analyses in the scientific control of combustion and chemical processes.